USING COMPUTERS IN THE TEACHING AND LEARNING OF MATHEMATICS IN SENIOR SECONDARY SCHOOLS AROUND MAFIKENG AREA PROJECT OFFICE

BY

L. M. ENIHE
(16074424)

A MINI-DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF *MASTER OF EDUCATION (EDUCATION TECHNOLOGY)* AT THE MAFIKENG CAMPUS OF THE NORTH-WEST UNIVERSITY

SUPERSVISORS : 1. MR V. NGAMBI
2. PROF J.R. DEBEILA

MONTH AND YEAR : JUNE 2012

DECLARATION

I, **Lillian Madikobe Enihe**, declare that **"USING COMPUTERS IN THE TEACHING AND LEARNING OF MATHEMETICS IN SENIOR SECONDARY SCHOOLS AROUND MAFIKENG AREA PROJECT OFFICE IN THE NORTH WEST PROVINCE"**, is my own work. It has not been previously submitted for examination at this or any other university. All materials used have been duly acknowledged.

SIGNED:_____

LILLIAN MADIKOBE ENIHE

ACKNOWLEDGEMENTS

I wish to thank the following people for motivating and assisting me in this study. I would like to acknowledge their contribution and express my gratitude to:

- Mr Ngambi, V. my supervisor, for the support and encouragement he gave me during my study period.
- Prof Debeila, J. R. my supervisor, whose professional guidance and monitoring made it possible for me to complete my study. I pray that God will give him total healing.
- All teachers and learners who participated in my study.
- The Area Project Office manager for granting me permission to conduct a research in the senior secondary schools around Mafikeng in the North West Province.

DEDICATION

his study is dedicated to the following people:

- My darling husband, Charles Enihe, for the motivation and support he gave me while I was busy with my studies.
- My two dearest children, Nosakhae Theophilus Enihe (son) and Dunkele Daniella Enihe (daughter), for understanding my late arrival at home.

ABSTRACT

The research study sought to investigate the following research hypotheses; computer is an effective tool in the teaching –learning of Mathematics teachers and learners are facing challenges or have barriers that hinder them from using computers in their lesson presentations; teachers and learners are computer illiterate and administrators at schools around Mafikeng are using computers.

The population for this research study was drawn from Senior Secondary Schools in the Mafikeng Area Project Office. A sample of 20 schools was used whereby 300 learners were randomly selected and 40 Mathematics teachers were purposely selected. Two questionnaires were used, one for teachers and one for learners for the purpose of data collection.

Quantitative approach was used to analyse the research data. The main findings were that: Most teachers and learners are computer illiterate; few teachers make their own arrangements to attend private institutions and pay their fees to be trained to use the computer. Some private sectors in North West Province donated computers to most schools but training was not given to any teacher. There is a dire need and interest in teachers and learners to use computer since teachers noted that it reduces workload and paper work.

It is recommended that: The Department of Education provide training of teachers for using computers in teaching Mathematics, distribute finances evenly that can allow schools to build computer laboratories in schools and those schools with computers should consider standardising their computer software.

Key words:

(i) The Mathematics teaching and learning
(ii) Challenges related to using computers
(iii) Teachers' and learners' perceptions
(iv) The current use of computers in MAPO.

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

MAPO - MAFIKENG Area Project Office

DOE - Department of Education

OBE - Outcomes-based Education

NCS - National Curriculum Statement

NCTM - National Council of Teachers of Mathematics

CST - Critical Science Research

BSCS - Biological Science Curriculum Study

ITEA - International Technology Education Association

IQMS - Integrated Quality Management System

AECT - Association for Educational Communication and Technology

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION AND BACKGROUND OF THE SYUDY

CHAPTER 2

LITERATURE REVIEW

CHAPTER 3

RESEARCH METHODOLOGY

CHAPTER 1

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND OF THE STUDY

Technology improves understanding and thinking skills such as critical thinking, analytical and manipulating skills etc. Pudi (2007; 38), cited that technology education is designed to enable and equip learners to perform effectively in technological environment in which they live and to stimulate them to contribute to its improvement. It is concerned with the technological knowledge and skill, as well as technological process; it also involves understanding the use of technology and its impact on both the individual and society.

According to Pudi (2007:39), Technology Education is about learning how a computer is used as a tool more than learning "about" computer. This study is directed to the usage of the computer as a tool for lesson planning and presentation of Mathematics in public schools within Mafikeng Area Project Office. According to Department of Education (DOE) (2003:77), a learner who studies Mathematics will be able to use Science and Technology critically and effectively by showing responsibility towards the environment.

According to Pudi (2007:16), Technology Education can be another way for closing the gap between the old and the new system and it depends only on how the authorities are introduced and how teachers and learners accept it in their different schools. In the South African situation, Technology Education is seen as a surrogate of Outcomes- based Education (OBE) and Curriculum 2005(C2005). There should be an introduction of technology in Curriculum 2005 and the technological process as a tool that can be used to integrate the curriculum (Pudi, 2007:46).

Hence in South Africa, the introduction of Technology in Curriculum 2005 (C2005) is not a mistake because technology can be integrated with other learning areas especially Mathematics, whereby the use of knowledge, skills and resources are achieved by

developing practical solutions to problems faced in everyday situations. According to DOE (2003:34), in the National Curriculum Statement (NCS) policy, one of the learning outcomes in Mathematics, is data handling, whereby learners are expected to use computers to collect, analyze, summarize data and draw conclusions.

Since the use of Computer Technology is regarded as a powerful tool in the teaching -learning process, one might expect that Mathematics teachers would use it in their teaching lessons to enhance their teaching and to model their use for learners. Technology is an essential tool for teaching and learning Mathematics effectively; it extends the Mathematics that can be taught and enhances learner learning. With calculators, computer software tools, learner can extend the range and quality of their mathematical investigations and encounter mathematical ideas in more realistic settings.

Powerful tools for computation, construction and visual representation offer learners' access to Mathematics content and context that would otherwise be too complex for them to explore. Using the tool of technology to work in interesting problem context can facilitate learners' achievement of a variety of higher-order learning outcomes, such as reflection, reasoning problem posing, problem solving, and decision making. (National Council of Teachers of Mathematics, NCTM (2003: iv-1).

1.2 STATEMENT OF THE PROBLEM

In the Mafikeng Area Project Office Schools, computers are being used by teachers and researchers for administration purpose. A question may arise as to whether school teachers use computers effectively and efficiently in their every day work. Do Mathematics teachers in the senior secondary schools in the Mafikeng Office Project Area use these computers effectively in their daily teaching? Do learners and teachers have computer literacy? Do teachers use appropriate methods and approaches for computer based learning? Do learners use Mathematical programme on the computer?

This study aims to find out the regularity use of computers as a tool in technology Education as

well as factors that affect the use of this tool in Senior Secondary Schools in the teaching of Mathematics around Mafikeng area.

1.3 AIM OF THE STUDY

1.3.1 To investigate the use of computer technology in Mathematics in the Senior Secondary Schools around Mafikeng Area Project Office (APO);

1.3.2 To establish the challenges and problems which Mathematics teachers and learners face when using computer technology in their teaching and learning.

1.3.3 To suggest alternative ways of encouraging teachers to use the computer as a tool for the teaching of Mathematics in the senior secondary schools around Mafikeng Area to stimulate learners' interest in the classroom.

1.4 HYPOTHESES

Johnson & Christensen (2008:80) define hypothesis as a formal statement of the researchers' prediction of the relationship that exists among the variables under investigation. These statements must be tested whether they are valid or not. The test takes the form of literature survey and different data collection and analysis mechanisms.

The following hypotheses are regarded as important in finding out the extent to which Mathematics teachers are capable of using computer technology as an instructional tool in their teaching lessons.

1.4.1 Learners' skills and concepts are enhanced when teachers use computer technology during lesson presentation of Mathematics.

1.4.2 Poor computer literacy level of teachers and learners inhibits the use of the computer in the teaching and learning of Mathematics.

1.4.3 Computers are not effectively used as an aid in the teaching and learning of Mathematics.

1.4.4 The lack of computer software and hardware in senior secondary school in the Mafikeng Area Project Office results in computers being used for administration purposes.

1.5 IMPORTANCE OF THE STUDY

In every school, Mathematics programmes should provide learners and teachers with access to the tools of technology, including appropriate calculators, computers with Mathematical software, internet connectivity, hand held data collection devices and sensing probes. Pre-service and in-service teachers of Mathematics at all levels should be provided with appropriate professional development in the use of computer as a technological tool, the development of Mathematics lessons that take advantage of technology-rich environment and the integration of technology into the day-to-day instruction. Curricula and courses of study at all levels should incorporate the computer as a tool in objectives, lessons and assessment of learning outcomes. Teachers should make informed decisions about the appropriate implementation of technologies in a coherent programme (NCTM, 2003:iv-2).

In the secondary schools in Mafikeng APO there might be some challenges that schools are facing in their use of the computer as a tool for the teaching and learning of Mathematics. The challenges could centre around the attempts of purchasing computers for instructional purposes, their installation, maintenance and replacement which are unavoidable, computer experts with the technical know-how and computer dealers who are profit conscious, as well as lack of funds because some of the senior secondary schools in the Mafikeng APO are no fee paying schools.

Another impediment to the use of computer in the classrooms could be attributed to the syndrome of resistance to change among teachers. Facilities such as adequate air condition, appropriate computer environment and buildings are not provided. Furthermore, electricity

which is the primary source of power supply to computers may not be stable and these may cause damage to the computer system.

It is envisaged that this study will:

- Highlight the effectiveness of using the computer as a tool in the teaching - learning process of Mathematics in the senior secondary schools around the Mafikeng Area Project Office (APO).
- Bring awareness to teachers and learners about the significance of computer as a tool in technology Education in their every day teaching and learning.
- Make education policy makers and pedagogical experts aware that there is need to plan and develop new methodologies so that this tool may be incorporated into the everyday teaching practices.
- Allow teachers to discover for themselves how computer technology can enhance the teaching and learning process in their daily practices.

1.6 RESEARCH METHOD

This study uses the quantitative and follows the quantitative design or strategies. In this study the survey research method was applied. Saunders et al. (2003:328) argue that quantitative data analysis is a field where it is not all difficult to carry out an analysis which is simply wrong, or appropriate for a purpose. And the negative side of readily available analysis software is that it becomes that much easier to generate elegantly presented rubbish.

1.6.1 Survey

According to Fraenkel & Wallen (2008: G-8), survey is an attempt to obtain data from members of a population (or a sample) to determine the current status of that population with respect to one or more variables.

1.6.2 Population

Johnson & Christensen (2008:596) define population as the large group to which a researcher wants to generalize the sample results. It is a set of all elements. According to Drew, Hardman & Hosp (2008:83), population refers to all constituents of any clearly described group of people, events, or objects who are the focus of an investigation. In this study the population is made up of the 40 secondary school teachers and 60 learners from twenty schools in the MAPO in Ngaka Modiri Molema District in the North West Province.

1.6.3 The sampling technique

Sampling refers to the procedure by which a given number of subjects from a population are selected to represent that population (Leedy & Ormrod, 2001:73). In addition; Johnson & Christensen (2008:600) define sampling as the process of drawing a sample from a population. In this study purposive sampling will be used for teachers who are teaching Mathematics and random sampling will be used for learners. .

1.6.4 Research instruments

This study applied the personal questionnaire described by De Vos (2002:173) as the one handed personally by the researcher to respondents. The questionnaire was administered to 100 respondents. Literature study and document analysis were used.

1.6.5 Data analysis

This data has been displayed by making use of tables and different graphs. This research uses percentages and frequencies as dictated by these collected data.

1.7 LIMITATIONS AND DELIMITATIONS

This study is intended to assess the use of computer as a tool for the teaching and learning of

Mathematics in senior secondary schools in Mafikeng APO. A sample of schools was used in the research study. The samples of schools were chosen from 20 secondary schools in Mafikeng APO with computers, but were not necessarily using them on a daily basis. Learners of the randomly chosen secondary schools participated in the research study. Teachers who are teaching Mathematics participated in the research study. Due to time frame and financial constraints, the study did not include all the secondary schools in the Mafikeng Area Project Office in the Northwest Province in South Africa. The study was delimitated to learners and teachers of all the 20 senior secondary schools of Mafikeng Area Project Offices.

1.8 TRUSTWORTHINESS OF THE STUDY

According to (Lincoln, et al. in Maree, 2010:299) trustworthiness refers to the way in which the inquirer is able to persuade the audience that findings in the study are worth paying attention to and that the research is of high quality. The study is said to be trustworthy if it satisfies these aspects: dependability and reliability, explanation will be done in chapter three.

1.9 DEFINITION OF TERMS

1.9.1 Technology

"Technology" in its broadest sense can include both hardware, such as interactive whiteboards, smart tables, handheld technologies, tangible objects and software e.g. computer-supported collaborative learning systems, learning management systems, educational games etc, (Goodyear & Retalis, 2010:8).

1.9.2 Technology Education

According to the International Technology Education Association (ITEA), technology education is best described as applied human knowledge or "human innovation in action". In this study learners learn to extend their human capabilities by way of designing, inventing, innovating, practical problem-solving, producing, communicating and transporting.

1.9.3 Computer

A computer is an electronic device which has a memory but cannot "think"; it can do only what it is programmed to do. Adekomi (2001:444) defines computer as a combination of related devices capable of solving problems by accepting data, performing described operations on the data and supplying the results of these operations.

1.9.4 Educational Technology

"Educational Technology is a complex, integrated process involving people, procedures, ideas, devices and organization for analyzing problems and devising, implementing, evaluating and managing solutions to those problems, involved in all aspects of human learning", (Lems, 1979:12).

1.10 ORGANIZATION OF THE REPORT

The chapters and major headings of this study have been organized as follows:

CHAPTER 1: INTRODUCTION TO THE STUDY

In this introductory chapter, the researcher discusses the background of the study and the statement of the problem, outlining the hypothesis together with the purpose of the study, limitations and delimitations of study, limitations and definitions of terms used in the research are explained.

CHAPTER 2: REVIEW OF RELATED LITERATURE

In this chapter the researcher presents literature that is related to the use of computer for the presentation of Mathematics and Mathematical Literacy in Senior Secondary Schools and the theories related to such study.

CHAPTER 3: RESEARCH PROCEDURES OR METHODOLOGY

The methods that are used to collect data are discussed including the sample and sampling, instruments to be used.

CHAPTER 4: DATA ANALYSIS AND FINDINGS

The analysis of the data includes procedures and statistical technique used.

CHAPTER 5: SYNTHESES, DISCUSSION OF FINDINGS AND RECOMMENDATIONS

It deals with the finding based on the problem statement of the research and recommendation thereof.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The integration of Computer Technology in Mathematics teaching and learning in South Africa is a challenge that can have far reaching consequences, if not properly done. Teachers are faced with the problems of having to deal with outcomes-based education (OBE) whilst still embracing the National Curriculum Statement (NCS) in being gradually phased in. Teachers are still struggling to get grips of the new curriculum, which is a major challenge on its own. The literature review focuses on challenges that Mathematics teachers and learners face in using the computers as a tool in teaching and learning process. The following aspects are considered as being important in this review:

- The theoretical framework underpinning this study.
- The effective use of computer as a tool in the Mathematics teaching and learning situation.
- Problems/ challenges related to the use of the computer in teaching and learning Mathematics.
- How do teachers and learners perceive computer usage in teaching and learning Mathematics?
- How the computer is currently used in secondary school Education in the Mafikeng APO.

2.2 THEORETICAL PERSPECTIVE

"A research paradigm is an all-inclusive system of interconnected practice and philosophy that define the nature of the investigation for researchers along three elements of ontology, epistemology and methodology" (Terre Blanche et al., 2006:6). The main conceptual frameworks in research are positivism, critical social research (CST) and interpretivism (Henning et

al.,2004:17). The positivist researcher adopts the philosophical stance of natural science, using objective analysis, composedly creating detached analyses about the gathered data in a selfless manner and emphasizes structured methodology and scientific observations that utilize statistical analysis (Saunders et al.2003:83).This study will focus on constructivist theory.

There are three theories- (i) the behaviourist, functional and constructivist theories. The behaviourist (Skinner: 1) focused on the voluntary behaviourist that he believed made most of an individual's behavioral repertoire. According to the behaviourist, learning is said to have occurred when learners consistently behave in the desired way in response to the specific environment. Learners learn without instruction but instruction provides "special contingencies which enhance learning" (Newby, 2006:35). Teachers should use cues to guide learners to the goal and consequences to reinforce desired behaviour. Reinforced behaviours are more likely to reoccur.

Constructivism emphasizes the active role of learners in learning and understanding (Provenzo, 2005:99). The constructs describe learning as a change in meaning constructed from experience. Knowledge is a subjective interpretation of experience. In this study constructivism is relevant to the use of the computer as a tool in the teaching and learning of Mathematics and Mathematical Literature, because Bruner stressed that learning is an active process in which learners construct new ideas or concepts based on their current or past knowledge. The learner selects and transforms information, constructs hypotheses and makes decisions, relying on a cognitive structure to do so.

Constructivism is a learning philosophy that proposes that learners need to build their own understanding of new ideas. Problem-based learning is a methodology in which learners are actively constructing their own knowledge; it is in essence a constructivist philosophy. The Biological Science Curriculum Study (BSCS) has developed an easily implemented instructional model of constructivism, or helping learners to build their own understanding of new ideas, called the "five E's". Engagement, Exploration, Explanation, Elaboration and Evaluation (Ronis, 2008:28-29).

Learners take part during the engagement by establishing and listing the facts, outline and describe the problem which is possible in Mathematics. Learners are able to ask questions, define a problem, showing a surprising event and acting out a problematic situation in which teachers can engage learners and focus them on the instructional tasks.

Learners explore when working together in teams. They make charts, tables, graphs, drawing, model internet research enquiries and field investigations. Team projects are ideal environments for guided enquiry and discovery. For learners to acquire problem solving skills in Mathematics and Mathematics literature, they need to work together in teams. Explanation is the point at which the learner begins to put the abstract experience he/she has had into a communicable form. For instance, learners expand on the concepts they have learned; make connections to other related concepts; and apply their understanding to the world around them. Evaluation is an ongoing diagnostic process that allows teachers to determine whether learners have attained understanding of concepts and knowledge (Ronis, 2008: 29-32).

Constructivism clearly represents a fundamental change in all aspects of the teaching and learning process. Teachers cannot be expected to embrace these changes without adequate preparation involving hands-on experience and modeling in the adoption of these new methods. The five "E's" instructional model of constructivism is relevant to the use of computer as a tool in Mathematics because geometry software allows learners to experiment with properties of shapes and draw conclusions about relationships when measurements are adjusted. Data collection and graphing software enables learners together to organize and analyze data by graphic representations (Ronis, 2008:35).

Instructional programmes include mathematics software that enables learners to explore shapes and shape properties and this is one of Mathematics learning outcomes. Instructional software consists of drill and practice, problem solving and simulations that build conceptual understanding and they are engaged, they participate actively. Time spent on the Internet enhances learner understanding of the primary content areas with mathematics and mathematics literature, including numbers and operations, algebra, measurement, reasoning, geometry, data analysis and probability and applied and advanced mathematics and evaluate

themselves.

Effective use of technologies depends on instructors closely monitoring learning outcomes and revising instruction better suited to the demands of their learners. Computers and calculators will never replace the teacher who uses technology in the classroom. Teachers of Mathematics should use technology for basic concepts and develop lifelong mathematics and mathematics literature skills to simulate real world situations that promote logistical reasoning and theoretical connections and encourage prediction and problem solving strategies rather than computation only (Ittigson and Zewe in Tomei (2003:60).

2.3 THE EFFECTIVE USE OF THE COMPUTER AS A TOOL FOR TEACHING AND LEARNING MATHEMATICS

Ittingson & Zewe (2003:61) agree that technology is important in the teaching and learning of Mathematics. Technology improves the way mathematics should be taught and also enhances learner understanding of basic concepts. It also gives rapid and accurate feedback to learners and this contributes toward positive motivation. Another importance of using the computer is that it allows learner to focus on strategies and interpretation of answers rather than spend time on tedious computational calculations. Computer teaching support constructivist pedagogy wherein students use technology to explore and reach the understanding of mathematical concepts. The constructivist approach promotes higher order thinking and better problem solving strategies which are in line with the recommendations forwarded by the National Council of Teachers of Mathematics (NCTM).Learners would then use technology to concentrate on problem-solving processes rather than on calculations related to the problem, gain access to mathematics beyond learners' level of computational skills, explore when they work together.

Nigeria introduced Computer Education and literacy in secondary schools in 1997 since the state government saw that computers transform the school system and equip the individual or learner with thorough understanding of the concept of the computer to fit into the next century (Bada, Adewole & Dlalekan, and 2009:443).The Federal Government of Nigeria had the

following objectives when it introduced computer Education and Literacy in secondary schools:

- To bring about computer literacy in each State in Nigeria
- To develop the use of computer as teaching tool in all subject areas and to familiarize students with the use of computer technology.
- To enable the present generation of school children at the secondary school level appreciate the potential of computer and be able to use the computer in various aspects of life and later occupation and lastly to expose the teachers and the learner to the latest scientific knowledge and skills.

There was a need for computer Education in Nigerian secondary schools because, according to Fajola (2001:152) the computer is diligent and consistent in its mode of operation; as it does not suffer from tiredness or lack of concentration like human beings. The computer performs multi-functional roles in the teaching and learning processes at all levels.

According to Adekomi (2001:445), information can be stored in manual files in the computer magnetic disc and retrieved when needed. The computer can provide a convenient technique for designing and developing a course of instruction. It can also provide a dynamic interaction between students and instructional programmes not possible with other media.

Ruthven & Hennessey (2002:20) agreed that the study of computer usage has shown a noticeable increase internet use in England, USA, Singapore, Canada, Hong Kong and Korea. Ruthven and Hennessey went on further to indicate that for the majority of other countries the usage remains low and growth is very low. In developing countries like South Africa there is an increasing pressure to ensure that technological possibilities are viewed in the context of educational needs.

Computers have become widespread in American culture and all workers are regularly using computers as part of their work. Computer use is more common among people with higher levels of education. By the year 2000, the average in each public school in the United States had

approximately 110 computers and had access to the Internet. As computer prices have gone down and with increased Internet use, computers are being more and more integrated into regular classrooms in the U.S, three or four at least in the classroom (Provenzo, 2005:147).

According to Wilson (2000: 230), appropriate use of the computer as a tool can enhance Mathematics teaching and learning support conceptual development of mathematics : it enables mathematical investigations by learners and teachers and influences how Mathematics is taught and learnt. Mistretta (2005:23) has also found the benefits of using mathematics software to include the following:

- Introducing learners to collection and analysis of data. Database and spreadsheets give learners confidence of analyzing large amounts of data accurately.
- Developing and maintaining learners' computation and communication skills. Calculators and graphic calculators accelerate the speed of learners when solving problems which result in more accurate results and improved learners confidence in mathematics and mathematics literature. Promoting learner's higher order thinking skills. Mathematical games and simulations help learners to apply mathematical ideas to problem situation.
- Showing the learners the role of Mathematics in an interdisciplinary setting-Integrated Mathematics packages allow learners the opportunities to explore problem-based learning.
- Facilitating learners' algebraic and geometric thinking - Geometric software and algebraic systems offer learners a bridge from the abstract world of Mathematics to the concrete world wherein learners are able to create and observe numerical representations, symbolic representation and geometric representation.

Oldknow & Taylor (2002:107) indicate that computer as technology offers young children the ability to explore and solve problems involving large numbers at an early age, investigate characteristics of shapes using dynamic geometry software and organize large sets of data.Pudi (2007:60) notes that the relationship between technology and mathematics is more than just cordial. He stresses that the importance of technology in promoting mathematical and scientific knowledge must be instilled in the teachers and learners. Pudi (2007:63) further elaborates the relationship between technology and mathematics as a way of thinking because

it provides one with strategies for organizing, analyzing and synthesizing data largely but not exclusively numerical. It also serves as a link between critical and creative thinking and pupils thinking and reasoning abilities are sharpened as they solve numerical problems. Pudi (2007:64) sees Mathematics as an activity of the mind involving actions as well as objects.

Mathematics is a tool used to achieve mathematical, scientific and everyday ends and means as brought forth by computer as technology. Computer serves as a communication medium in Mathematics and Mathematical Literature. Technological concepts, such as graphs and formulae, are conveyed through mathematical symbols.

For the effectiveness of using computer as a tool in the teaching and learning Mathematics, the schools must make certain that the following occur:

- There is a sufficiently available computer technology support and maintenance as well as appropriate software.
- The use of technology has linkages to important educational learning expectations.
- Teachers have the necessary skills and knowledge to effectively model and teach exemplary uses of technology.

For the effective use of computer technology teachers need to be highly involved by interacting and providing feedback to learners. Researchers indicate that appropriate technology use can be very beneficial to increase educational productivity. Valdez (2005:7) indicated that technology may be effective in mathematics when used to access information from the internet and used to communicate findings to others by using graphs, illustrations and animations as well as to simulate and solve real problems.

Valdez (2005:7) noted that the effect of technology on learners' access to knowledge is determined by the pedagogical knowledge and skills of teachers because without strong teacher knowledge of how to use technology Education, a lot of time can be wasted. Valdez (2005:7) has identified seven factors that are critical in manifesting effective good practice of computer use:

- Communicate high expectations
- Give quick feedback
- Encourage contacts between learners and faculty, especially those learners who are willing to speak in classroom settings
- Use active learning techniques that make learners active learners.
- Develop reciprocity and cooperation among learners allowing for the benefit of peer learning.
- Emphasize time on task.
- Respect diverse talents and ways of learning.

According to Valdez (2005:9) technology Education is recognized as a powerful means to boost learner achievement. But for technology to work, curriculum and instructional methods need to be expanded to match the variety and rich learning options that these technologies are making possible. Drill-and-practice software was quite common and readily available in the 1970s and 1980s and often mimicked flash cards (Morrison, 2002:180). The computer displays a stimulus such as a Mathematics problem or foreign vocabulary word and the learner would select or enter an answer. It provides some type of response ranging from a simple line of text indicating the correctness of the answer to eye-catching graphics and sounds.

Drill-and-practice software is not used to teach new information but it reinforces existing knowledge such as multiplication facts. Drill-and- practice is an efficient way to achieve rote learning objective. Current educational trends question the value of the rote learning that this type of software promotes. Tutorials are another form of popular instructional software. Tutorials attempt to teach the learner new information and strategies that can range from a simple implementation of programmed instruction of a highly sophisticated application that allows for branching and adaptation to individual differences. Tutorials are useful for the introduction of new content and remediation. Educational games are often based on a drill- and practice approach and usually provide an interesting theme such as solving Mathematics problem to save the earth from an alien attack. Games are a variation of drill-and-practice software, sometimes adding a time variable. Learners may also be able to achieve various levels of proficiency to reflect their performance rather than a reporting of the number of correct items.

Using computers as tools can help teachers create learner-centred learning environment. Learners create an understanding of the world that will lead to the development of knowledge (Morrison, 2002: 183). The computer is used as an extension of what the learners are able to do for themselves because computer functions closely align with learners' abilities. The computer is used as a tool by learners to extend their capabilities (Provenzo & Eugene, 2005:205).

Today's technology can offer adolescents a bridge from concrete to abstract thinking, enabling them to observe and create multiple representations of mathematical ideas numerically, graphically and symbolically. Learners can use geometric construction software to investigate the relationship between the circumference and diameter. They can plot the values and estimate a "best fit" (graphical representation).Learners can determine the best fit equation (symbolic representation).

Computer as technology can also help teachers respond to learners' diverse learning styles by creating rich environments that engage learners' tactile, visual, and auditory senses. Word processing, calculators, spreadsheet tools, and the Internet can enable middle-grade learners to begin learning higher communication and problem solving skills-abilities that are essential to mathematical thinking (Moila, 2006: 32). Technology has been proved to accommodate learning styles and to be effective motivators for learners with specific learning needs. Learners working in collaborative-term-learning settings appear to function better when learning events are accompanied by technology use. Computer as technology also is important when used to provide distance learning opportunities to learners who would not have access to course offerings. Computers and other technology can play many technological roles, from personal tutor and information source to data organizer and communication tool. It is important for teachers to consider how computers and other electronic technologies can enhance the learning experiences of learners and increase their productivity.

The effective use of computers as a tool in technology Education is possible if enough attention is given to:

- Curriculum uses.
- Instructional pedagogy uses.
- Sufficiency of computer and access to the Internet.
- Ability of the teacher, especially, to model uses of computer.
- Assessments used. (Valdez, 2005:9).

In the olden days the computers were big, slow and very expensive. With the development of technology they are small, cheap and fast. Together with other technological devices, they generate and process information quickly. Thus information becomes quickly and easily accessible. However, this remains true for developed countries. For developing countries, it is a challenge they have to face if they want to survive and stay competitive in the global village (Haddad & Draxler, 2002:167).

Clements (2000:19) indicates that computers in the classroom contribute to cognitive development. He further explains the different ways in which computers can be introduced in a classroom, which correspond with research conducted by Means (1994), Bruce and Levin (1997) in Taft (2000) on the application or uses of computers in the classroom. For them, the technology takes the following form:

- Training tool - Learners can use technology in online quizzes, drill and practice software, or programmes that guide learners through specific concepts or problems, serving as a tutor.
- Research tool-Learners can use technology in exploring and accessing information from online resources, networked libraries and CD-ROM.
- Intellectual development tool- Learners can use the computer to construct and produce a variety of information through engaging in interactive games and real life simulations and
- Communication tool - Learners can use the technology as a medium of communication through the different network levels that are available.

Computer has become a very powerful tool to develop abstract thinking which should be reflected also in assessment. Computer supports learner performance of complex tasks that are

similar to those performed by adult professionals or fill a genuine need of the learner. Computer is integrated into activities that are a core part of the classroom curriculum. It is treated as a tool to help accomplish complex tasks that engage learners in extended and cooperative learning experience that involves multiple disciples. Teachers should use the teaching approach that suits their paradigm of teaching and learning especially Mathematics. The use of computer as a tool provides teachers with opportunities for traversing an entire continuum of possibilities as may be appropriate to their teaching needs.

Frith (2004:159) found that the lecture room tutorial taught learners how to calculate the various statistics, the computer tutorial was more effective in giving the learners understanding of the concepts and learners retained better what they had learned. This effect, learners argue, is possible due to the shift in emphasis in the computer-based tutorials away from mechanical calculations to demonstrating conceptual understanding. Technology Education was used to complement teaching and learning and to support the development of learners' mathematical literacy skills. In this new generation of learners, Mathematics is a requirement for future success. Learners should achieve literacy in all subject areas by the time they graduate from high school. Problem-based learning encourages learners to become literate by allowing them to use standards in various contexts to solve problems, hence literacy in mathematics and technology is not optional. Many basic mathematics skills are essential for numeracy, including arithmetic, percentages, ratios, simple algebra, measurement, estimation, logic, data analysis and geometric reasoning hence computer plays an important role in these subjects.

Problem-based learning activities and lessons develop learners' problem-solving and decision making abilities through the use of human and material resources, processes and technological systems. It also prepares learners for life-long learning in a technological society because it exposes students to activity - oriented laboratory experiences that reinforce abstract concepts with concrete experience (Ronis, 2008:34). Mathematics is traditionally isolated from the rest of the curriculum and high school mathematics especially focuses on preparing only those learners who intend to enter a profession that requires calculus (Wilkins, 2000:141).Teachers must encourage learners to see and use mathematics in everything they do. For measurement in science, for scoring and ranking in athletics and many more,

bearing in mind that technology is the "glue" that can enable them to approach Mathematics.

Computer can offer learners the tools and information they need to explore Mathematics connections in the real world. Gathering and interpreting of information becomes simple. Teachers and learners can quickly transport data from CD-ROMs and the Internet into spreadsheets, word processing programmes and multimedia presentations or they can view these data from the computer screen using a projection system. By using computer as a tool, learners practise Mathematics skills. Computer supports and facilitates conceptual development, exploration, reasoning and problem solving by empowering learners and teachers to investigate questions that reflect their own interest.

Computer placement and the classroom environment in general should increase communication among learners, not stifle it. Computers must engage learners in independent exploration. Computers hold remarkable promise for teachers in terms of their day-to-day work. Much of the work of teaching involves record keeping, searching for new information and creating collections of teaching materials as well as providing individualized instruction. Computers can help in all of these tasks. Computers change the ecology of the classroom because they change the process of teaching and learning. Teachers can never complain about a lot of paperwork again.

According to Provenzo (2005:29), the three roles for computer in education are tutor, tool and tutee. As tutor, the computer functions similar to traditional teaching or instruction. It directs the learners through drills and exercises where memorization and rote learning is required. It also takes the form of simulation, problem-solving activities as well as provides tutorials in specific areas. For computer as a tool, learners use it to extend their capabilities such as inventing, practical problem solving, producing and communicating. For example, a word processor extends the ability to write, while a drawing programme extends the ability to sketch or produce drawings. Tool applications and software are the most widespread and versatile use of the computer in education. As a tutee, the computer is the "learner" being programmed by the learner to accomplish specific tasks. Learner feed the computer with the information (Provenzo, 2005:96).

2.4 PROBLEMS OR CHALLENGES RELATED TO USING THE COMPUTER IN THE TEACHING AND LEARNING OF MATHEMATICS

South Africa currently faces a crisis in mathematics education which has seen it placed last in the third International Mathematics and Science Study (Martin, Mullis, Gregory, Smith, Chrostowski, Garden and O'Connor (2000:3). Computers are able to impact positively on mathematics and mathematics literature performance, placing this new technology in schools could help alleviate the deepening crisis.

There are many factors that affect computer technology implementation in teaching and learning Mathematics in secondary schools in the Mafikeng APO. The possibility of using computer as a tool when teaching Mathematics raises new questions about their proper integration in the school system. Presently, technology is present in every part of our everyday life and it is also more present in education. The question might be the challenges that the schools, teachers and learners are experiencing in the use of this computer. In schools the following are the factors or challenges affecting the use of the computer as a tool in the teaching and learning of Mathematics:

- Lack of technical support;
- Lack of computer infrastructure;
- Lack of learners computer skills;
- Teacher discomfort with computer;
- Low expectation of learners;
- The constraints of academic schedules and departmental structures; and
- Accountability pressures. (Valdez, 2005:14).

Mathematics must be learned with the intent to understand, with a view that it can be used and that it can be seen as a field itself worthy to study. Teachers need to learn more mathematics that allows them to develop deeper understanding of the mathematics they will be asked to teach and by so doing it will be easy to incorporate it with computer. Many teachers did not receive adequate preparation for the use of computer in their pre-service experience, teachers

have to make effective and efficient use even as they try to instruct and model the use of the available computer. Teachers may be frustrated when they realize that to use computer effectively, they will need not only to learn computer use and integration but that they may need to modify their instructional and assessment practices as well (Valdez,2005:15).

The need to use the computer as a tool is a challenge to teachers since it requires that the teacher re-thinks teaching and learning in his mathematics classroom, leading to contradictions between the use of the computer as a tool for drill and practice and its use as a creative tool for developing learners' understanding of Mathematics. Some teachers are less comfortable with computer than with other aspects of their teaching. Another problem concerns the hardware and software companies that purposely design products to become quickly obsolete and thus require updates that teachers must buy. It is their belief that technology Education is too much in its infancy and not yet reliable enough for use by most learners. Sometimes teachers use computers to entertain learners with irrelevant and unconnected activities because it makes their teaching lives easier and not that it benefits learners as they learn important content. Teachers use computer for relevant activities in the classroom, but learners who have access to computers at home may be problems to their parents. Some parents may be concerned about the effect that children are gaining so much of their world knowledge from a virtual rather than real, world because they access sexual and violent content on the internet (Valdez, 2005:17).

In Nigerian educational institutions, the challenges about the use of computer centre around the use of a huge some of money to be expended annually on the importation of computer hardware and other accessories including other educational technology equipment for training and capacity building and most of these hard and software materials are "inappropriate and ineffective" for use in their schools due to the absence of electricity. Another problem is that this hardware and software prototypes are hardly subjected to formative evaluation so as to determine their usefulness before such equipment can be mass produced for the use of a general learning public in their educational institutions. The other problems of using computer are the sophistication in construction and operations of most of the equipment, the absence of adequately trained staff for maintenance and repair and the non-availability of spare parts for the different types of technology equipment. The other problem is the compatibility and

standardization of equipment sold by different manufacturers (Adekomi, 2001:5).

The cost of computers can be a major problem for parents who do not work. But cost is not the only concern, even when funding is available and the computer is obtained it may not lead to successful use. Time needs to be spent in assessing learner needs and capabilities, helping learners and families become comfortable with the computer, and with installation, troubleshooting and maintenance of the equipment (Provenzo, 2005:173).

Herselman (2003:57) identifies three challenges that schools encounter in the use of computer in South Africa which are indicated as drawbacks:

- Basic drawbacks - issues that schools need to conquer before any computer connection can be done for improving access to quality education. They include lack of buildings and stationery and lack of experienced and skilled teachers.
- Communication drawbacks - issues that limit schools' access to local and global networking systems. They include lack of telephone facilities, lack of computer hardware and software and lack of technical training on the part of teachers.
- Other drawbacks - issues that do not directly relate to the technology but have an impact on the education of senior secondary learners, include lack of library facilities, lack of transport facilities, large number of teacher-learner ratio and lack of electricity connections.

Large class sizes make it difficult for teachers to employ interactive sizes and also make it difficult for teachers to employ interactive technology strategies (Nicol & Boyle, 2003:120) or to gain insight into the difficulties experienced by learners. Large classes pose problems for all learner but learners who are under-prepared are particularly affected. It is these contexts that provide useful opportunities for technology Education.

In South Africa, many under-prepared potential learners entering university do not possess the relevant Mathematical literacy skills required for certain courses (Frith 2004:159-171). Learners are often expected to pursue an extended undergraduate degree programme which

offers additional support to address mathematical literacy skills. The teaching challenge is that of finding ways of developing students' mathematical literacy skills. Self-contained interactive spreadsheet-based tutorials were developed for use on the mathematical literacy support courses. Typical tutorial consisted of interactive presentation of relevant mathematics content, examples and exercises.

Teachers and learners should not be expected to be computer infrastructure and support experts. The computer equipments they are using need to be dependable and easily accessible. Teachers need to experience computer as something that they can build lesson plans around and not worry that their planning efforts and schedules are frequently impossible because of equipment failure or that the negative experiences will lead teachers to believe that computer use is more problematic than helpful and will likely reduce their computer use substantially (Valdez,2005:19).

2.5 HOW DO TEACHERS AND LEARNERS PERCEIVE COMPUTER USE IN TEACHING AND LEARNING MATHEMATICS?

Teacher's computer literacy, attitudes and understanding of their roles is the first thing needed for the successful implementation of the computer as a tool in the teaching and learning of Mathematics. A deep understanding of mathematical teaching and learning environment gives guidance on the approaches that teachers can employ in teaching the subject.

2.5.1 The role of teachers in Mathematics teaching and learning

Golafshani (2002:33) sees a great deal of teacher's conceptions about the content influencing their instructional practice. He further indicates that teachers who perceive learning as accumulation of information are likely to view teaching as a transfer of information. Teachers will pump a great deal of information into learners' head. The approach to teaching tends to be more teacher-centred rather than learner-centred. On the contrary, Golafshani also identifies another type of teachers who perceive learning of Mathematics as helping learners to construct those subjects. Their approach is more learner- centred and through games, learners'

discussions and debates independent learning is encouraged. In order for the Mathematics teaching and learning situation to be more meaningful and practical, there is a need to come up with the learning environment that supports learner-centred approach and de-emphasise rote learning. Teachers need to understand what learners need to know and should be able to do, have immense mathematical knowledge and appropriate instructional strategies to meet the different styles of the learners.

Research carried out by Chen and Arvold (2002:62) in the USA, found that teachers belief systems influence the learners' image of mathematics. They went on further to indicate that teachers who are aware of their belief system might use this to expand or not expand learners, image about mathematics. The teacher understanding is of great importance, as it will influence the depth at which Mathematics is taught. The teachers will always be confident in what is being done with the learners in class and is not threatened or even challenged by the learners' questions. Such kinds of teachers are likely to motivate and encourage their learners develop a positive attitude towards those subjects which in turn improve development of a positive attitude and learners' performance in Mathematics.

2.5.2 The Teachers' and Learners' Perception about the use of computers in Mathematics

Pudi (2007: 246-247) has identified the features that the ideal Technology Education teacher should come to terms with:

- ✓ Teachers must know and understand the policy stipulated for the implementation of computer technology.
- ✓ Teachers must understand the nature of computer and its impact on the environment and the advancement of Mathematics in the individual and society.
- ✓ Teachers must make ethical decisions about computer-related issues, including the development and use of computer and computer software's.
- ✓ Teachers must also explore computer careers so that they give guidance to learners.

Attitudes cannot be ignored, but attitudes also help determine how successful computer implementation will be. A learner must want to be involved totally. When a person experiences difficulties, support - both technical and emotional - is very important. Therefore, it is important that teachers who teach Mathematics using computer must have the right attitude towards the computer use, because right attitudes are values that will enhance the capabilities of the teachers to be able to play their roles successfully (Pudi, 2007:251). Teachers must forget the myth that when computers are in place they will automatically lose their jobs since a computer will provide more information. This will not happen in any country, South Africa included.

Teachers' attitudes have been found to be major predictors of the use of new instructional technologies. The successful use of technology in the classroom depends to a large extent on the teachers' attitudes toward these tools. It has been suggested that attitudes towards computers affect teachers' use of computers in the classroom and the likelihood of their benefiting from training. Positive attitudes often encourage less technologically capable teachers to learn the skills necessary for the implementation of technology-based activities in the classroom. In a study conducted in Netherlands in 2007,the findings was that participants with negative computer attitudes were less skilled in computer use and were therefore less likely to accept and adapt to technology than those with positive attitudes. Individuals' negative attitudes, is essential for increasing their computer skills. Therefore, if teachers want to be successful using computer in their classes, they need to possess positive attitude towards the use of computer. Such attitude is developed when teachers are sufficiently comfortable with computer and are knowledgeable on its use (Afshari, et al., 2009:91).

According to Afshari et al (2009:92) teachers who have a strong engagement towards their own professional development are more motivated to undertake activities, which lead to a better understanding of the goals of an innovation. Afshari et al (2009:92), pointed out that teachers who are actively involved in their own professional development are more able to implement changes in their teaching.

2.6 COMPUTERS AND MATHEMATICS EDUCATION

Examples of software

The following section deals with examples of specific software used in the teaching and learning of Mathematics (Mhakure, 2003:40).

2.6.1 Shack's Mathematics Problems

Shack's mathematics problems are web pages of mathematics problems ranging from basic Mathematics to differential equations. Shackleford (2001:1) designed the mathematics problems. Each problem comes with a difficulty rating from one to four stars. This is roughly a measure of how much time it will take a learner to do the problem. For each problem asked, a solution or answer is provided. This will enable learners to assess themselves. The advantages of using computer as a tool is that: (1) the formative and summative assessment are more frequently, (2) teachers can be aware on how to adapt it in the teaching situation, (3) teachers spend less time marking, (4) it increased learners confidence, and (5) learners have immediate feedback and self assessment at the learners' own pace and time (Alter, 1993:23).

2.6.2 GridPro

GridPro is advertised as being a sophisticated grid-drawing package invaluable to any secondary school mathematics lesson or indeed any subject that might need customized graph paper. This package has a number of points in its favour including the ability to draw almost any kind of graph or tessellation on paper, the ability to save and recall any one of them in a moment's notice and the ability to print the chosen grid on any size of paper (Leacy, 1995:47).

2.7 HOW THE COMPUTER IS CURRENTLY USED IN SENIOR SECONDARY SCHOOL EDUCATION IN THE MAFIKENG AREA PROJECT OFFICE (MAPO)

Mafikeng Area Project Office currently has twenty (20) senior secondary schools, with at least

two or three teachers teaching Mathematics. Most of these schools have a minimum of eight to twenty classrooms and due to fewer enrollment of learners other classroom are converted into computer laboratories. Some of these schools are regarded as quintile 1, whereby parents are not paying school fund for their children; hence the governing bodies of the said schools raise funds to buy what is needed in school such as computers.

Some of these schools in MAPO have computers but others don't have computers. Those that have computers did not buy them; some were donated from private sector in the Northwest Province. It seems the private sector has done some evaluations before it could donate those computers, for example, they were looking at the availability of electricity, infrastructure and security as their major requirements without taking into considerations some factors within school curriculum and school needs even school maintenance.

In 2005 the new curriculum was implemented, Computer Application Technology, and Mathematics was amongst those new subjects in secondary schools, but no new teachers were employed. Some of those schools with computers managed to introduce Computer Application Technology in the school curriculum so that computers must not be confiscated. They employed private teachers to teach the learning area and use school funds to pay them, but the computers of other schools became white elephants, accumulating dust because teachers were not computer literate and only the administrators had access to computers.

Some of these schools do not have enough funds to employ private trainers to train the teachers to use those computers. Some of the Mathematics teachers have little knowledge about computers, because they are not trained to use them in their subject. Teachers work nowadays involves record keeping, classroom arrangement and management as one of the expectations in the Integrated Quality Management System (IQMS). The MAPO recently trains every year the Mathematics teachers on how to teach content but, does not teach them how to use the computer in their day to day lessons.

One of the learning outcomes in Mathematics is, collecting, organizing and displaying data. It is not possible for these learners to achieve the learning outcome if they don't use the computer

which can make their work easier. Teaching with computers can change the context in which teachers teach. It is up to the teachers to change from teacher - centred and rote learning approach so that learners can also change their mindset of having negative attitudes towards Mathematics. If learners are able to operate calculators, tape recorders and complicated cell phones; they are able to learn how to use computers (DOE: 2005).

For teachers to use computers freely, the school has to make sure that there is technical support for them and their learners. Among those twenty schools selected for this research, there are those whose enrollment is large and the teacher learner ratio not normal and amongst those learners others are with physical challenges. If schools in MAPO consider these challenges, performance of learners in the Mathematics might change. Teachers in senior secondary schools in MAPO need not wait for the Education Department to put pressure on them to learn computers. It is their duty to develop themselves so that they can be up to date and able to change and accommodate the new changes in the current curriculum. It is time for teachers to change their teaching approach or styles, for example, collaborative classrooms tend to be noisier than traditional classrooms and teachers who don't want to change believe that noisy classroom indicate a lack of discipline or teacher control.

In the collaborative classroom, learners need opportunities to move around, talk and ask questions. They can see the importance of coming to school and enjoy the lessons. There won't be a reason for them to absent themselves because they will know that when they are absent they have lost a lot that day. It is up to the teachers nowadays to change their mindset. Learners learn to work together when they play together (Ronis, 2008:30).Computer technology can enable learners to have more access to mathematics and to understand mathematics in more of a real-world context. Learners can visualize Mathematical information. They can see the importance and role of Mathematics in their world more easily and they can have a better chance of learning to value Mathematics rather than fearing those subjects. Young learners can begin to become confident in their ability to do Mathematics if teachers in the MAPO senior secondary schools encourage them to experiment with early Mathematics concepts such as patterns, shapes and sizes as one of the learning outcomes in these subjects

Learning to work together on computer projects and with computer software can teach learners the value of good citizenship related to sharing resources and reflecting the needs of others. Teachers need to be alert to the values they are conveying not forgetting that an envisaged kind of teacher is a teacher who visualises, competent, dedicated and caring to contribute to the transformation of education in South Africa,(DOE:2007).

The MAPO has a budget like other institutions, but Mathematics teachers have never undergone training for computer but every time they are expected to produce good results. It is time for the Department of Education in the Northwest, MAPO to revisit their budget so that at the end, none is to blame, even learners need to be considered in that budget (DOE:2007).

2.8 SUMMARY

Computer use in Mathematics teaching and learning might be inconsistent in senior secondary schools in Mafikeng Area Project Office even though there are high expectations. The use of computers in Mathematics in the teaching and learning can benefit both teachers and learners provided tools are used appropriately irrespective of the frequency of their usage. The belief system that teachers have will influence their approach to teaching and learning. Good or bad perceptions about the computer use as a tool in the teaching and learning are influenced by the teachers' belief systems. Good perception about the computer hardware and software use will influence what tools are used for, how they are used in teaching and learning and how often they are used.

This literature review is a reflection on the following questions:

- To what extent are the computer tools used in Mathematics teaching and learning in Mafikeng Area Project Office senior secondary schools?
- What are the challenges related to the use of computers in the teaching and
- Learning of Mathematics?
- What are teachers and learners perceptions on the use of computer in
- Mathematics teaching and learning?

- How are computers currently used senior secondary schools education in
- Mafikeng Area Project Office?

The next chapter 3 describes the research methodology that was employed in exploring the abovementioned questions.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the research methodology applied in the study, including the data collection method, the data collection instruments, the research population and the method of sampling used. According to Cohen, Manion and Morrison (2000:84), the aim of methodology is to help the researchers to understand the processes and products of scientific enquiry. The research methodology outlines and explains the relationship between the research problem, the data collecting instruments and the analysis of the research. In this chapter the researcher discusses the ways of collecting data with regard to the use of computer as a tool for teaching and learning Mathematics in the secondary schools in Mafikeng Area Project Office. The quantitative research method is applied in this study.

3.2 RESEARCH DESIGN

3.2.1 What is Research Design?

According to Johnson & Christensen (2008:305), research design refers to the outline, plan or strategy to use to obtain answers to research questions. The design describes the way evidence will be collected that will adequately test the research hypotheses. Cook and Cambell (2002:9) agree that research design deals with a logical problem and not a logistical problem. In this reseach study survey approach will be used.

3.2.1.1 Surveys

Surveys refer to a collective group of quantitative data collection technique that involves the administration of a set of questions or statements to a sample of people (Mertler 2009: 117).

Survey research involves describing the characteristics of phenomenon or group by means of such instruments as interview schedules; questionnaires and tests. Survey provides facts and estimates that can be used by decision - makers to gain insight into understanding the relationship and differences of phenomena. In this research it provides an understanding into the challenges that the teacher and learner are experiencing with the use of the computer as a tool for teaching and learning of Mathematics.

Surveys are very vital in education (Metler, 2009:400). The advantages of the survey method include ability to accommodate large sample sizes; ability to distinguish small differences, ease of administering and recording of questions and answers. However, the surveys have the following disadvantages for example, development of accurate survey instrument, inaccuracies created in constructing scale measurement of factors, limit to the in-depth detail of data structures, difficulties in determining if respondents are responding truthfully, misinterpretation of data results and inappropriate use of data analysis procedures (Trochim, 2000:55).
In this study, the researcher used a survey approach because it allowed the researcher to get structured information from teachers and learners. It also allowed the researcher to identify challenges and the effectiveness of the computer in the teaching and learning of Mathematics.

3.2.2 Research approach

According to Mertler (2009:248) research approach is the specific plan for collecting data in a research study. In this study quantitative approach was used.

3.2.2.1 Quantitative approach

Drew, Hardman & Hosp (2008:382) describe quantitative research approach as dealing with the collection of data in the form of numbers. In this approach, the occurrence of behaviour is counted, correct answers or errors are counted and other types of measures are recorded in terms of quantity.

Quantitative research, according to Comrade & Serlin (2006:395), is often concerned with the description of characteristics of a large group or the identification of differences between groups. The researchers used statistics calculated from the sampled data to estimate key parameters of the population with two key estimators underlying inferential statistics being those of the population mean and population variance.

3.2.2.1.1 Advantages of quantitative research

- Preference for precise hypothesis stated at outset.
- Preference for definitions stated at the outset.
- Data reduced to numerical scores.
- Much attention to assessing and improving reliability of scores obtained from instruments.
- Assessment of validity through a variety of procedures with reliance on statistical indices.
- Preference for random techniques for obtaining meaningful samples.
- Willingness to manipulate aspects, situations or conditions in studying complex phenomena.

3.2.3 Research population

According to Punch (2009:359), population is the target group, usually large, about whom to develop knowledge, but which we cannot study directly. Mafikeng District is divided into four Area Project Offices which are: Mafikeng, Setlakgobi,Rekopantswe and Botshabelo.Out of the four concentration will be on

Mafikeng since it has high number of teachers and secondary schools. In this study the population is made up of secondary school teachers and learners in Mafikeng Area Project Office in the North West Province. The MAPO consists of twenty secondary schools, number of Mathematics teachers estimated at 107 and learners doing Mathematics estimated at 1600.

3.2.3.1 Research sample

Saunders et al. (2003: 150) assert that sampling techniques provide a range of methods that enable the amount of data one needs to collect by considering only data from a sub-group rather than all possible cases or elements.

Figure 3.1. Random sampling methods

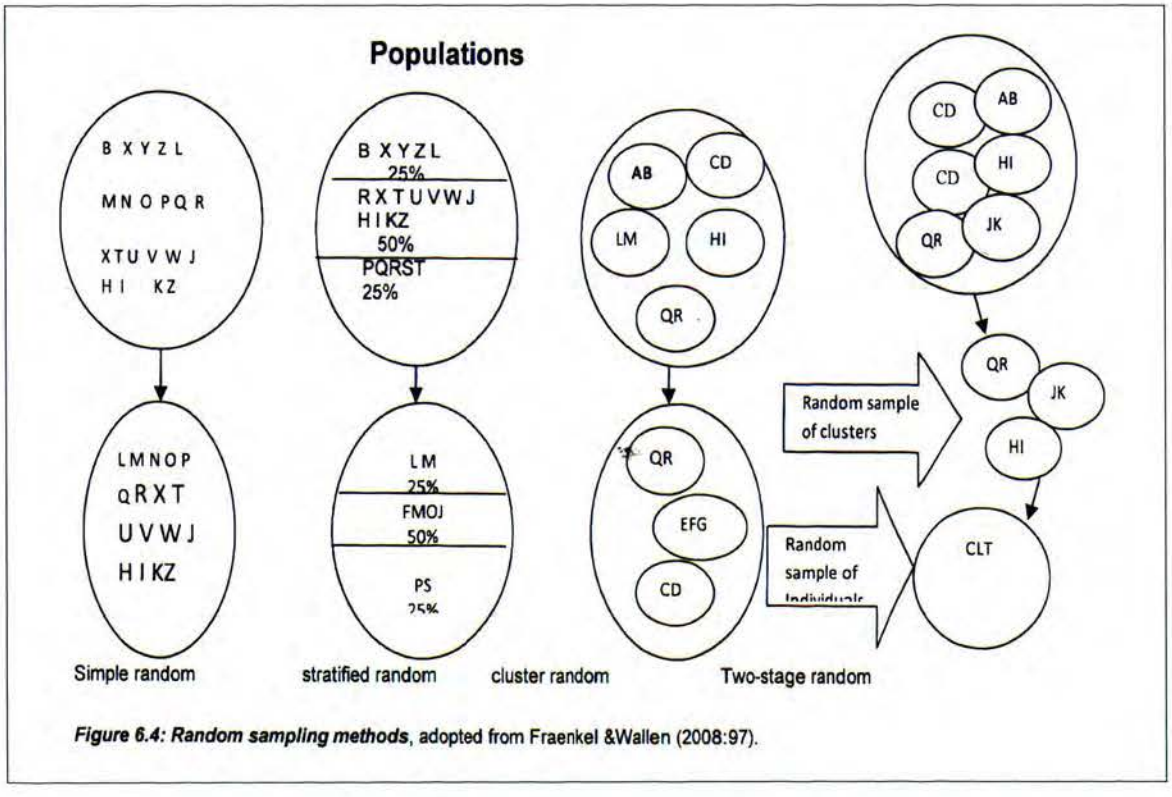


Figure 6.4: Random sampling methods, adopted from Fraenkel &Wallen (2008:97).

A sample drawn by a procedure in which every possible sample of a given size has an equal chance of being selected from the population. Cluster random is a form of sampling in which clusters such as schools rather than single unit elements such as individual learners, or teachers are randomly selected. In stage-two, a random sample of elements is drawn from each of the clusters selected from the larger set of all clusters in the population.

In this research study purposive sampling was used for teachers because those teachers have

knowledge about Mathematics and can provide new information regarding using computers in the teaching of Mathematics. Fraenkel & Wallen (2008: G-7) describe purposive sampling as a nonrandom sample selected because prior knowledge suggest it is representative, or because those selected have the needed information. Random sampling was done on learners, as they could not all be involved in the study.

According to De Vos (2002:201),noted that representativeness is always important when we want to generalize from the sample to the larger population,i.e.when we study a sample in order to conclusions about the population from which the clamed De Vos suggested the following table as an indication of what the size of a sample ought to be:

Table 3.1 Guidelines for sampling

Population	Percentage suggested	Number of respondents
20	100	20
30	80	24
50	64	32
100	45	45
200	32	64
500	20	100

3.2.4 Research instruments

The instrument for collecting data in this research is the use of the questionnaire, literature study and document analysis. According to De Vos (2002:172), a questionnaire is a set of questions on a form which is completed by the respondent in respect of the research project. The questions can be open (e.g. comments) or closed (e.g. Yes or No). The basic objective of a questionnaire is to obtain facts and opinions about a phenomenon from people who are informed on the particular issue. The closed-ended questions are structured according to the Likert scale on a five grid system; that is; strongly disagree; disagree; neutral; agree and strongly agree.

This study applies the personal questionnaire described by De Vos (2002:173) as the one handed personally by the researcher to the participants. The researcher limits his or her own contribution to the completion of the questionnaire.

3.2.4.1 Questionnaire

According to Johnson and Christensen (2008:203) "a questionnaire is a self data collection instrument filled out by research participant". Only two questionnaires have been used in this research study. One questionnaire for teachers and the other for learners.

3.2.4.1.1 Questionnaire for teachers

The questionnaire for teachers has three sections: Section A intends to get information on the personal details of the teachers who participated on the study. Teachers gave information to the researcher on aspects such as their gender, academic and professional qualifications, position held in school, age and teaching experience, terms of service, the subject he / she is teaching and the number of computers in their respective schools.

Section B of the teachers' questionnaire is to find out their perception on the use of computer as a tool in the teaching and learning of Mathematics in secondary schools. A five grid Likert scale was used. Also in Section B information was gathered about the effective use of computer as a tool and the challenges they are likely to face as they adopt a curriculum where technology plays a vital role in the teaching and learning of Mathematics in secondary schools.

Section C helps in finding out the challenges faced by teachers when using computers in the teaching of Mathematics.

3.2.4.1.2 Questionnaire for Learners

The questionnaire for learners has two sections; Section A and Section B. Section A is on the demographics of the learners who took part in the research study. Data collected on Section A involves demographic characteristics such as gender, age, whether Mathematics or Computer Science are part of their subjects and whether the learner has access to computer at home. Section B of the learners' questionnaire was intended to find out the perceptions of the learners on the use of computers as a tool in the teaching and learning of Mathematics. Likert scale of five-grid was used for strongly disagree, disagree, neutral, agree or strongly agree.

Section B helps in gathering information on the use of computers as a tool in the teaching and learning of Mathematics, the effective use of computers and the challenges they are facing when using computers to learn Mathematics. In this Section B, learners have the opportunity to point out how the teacher can assist them to use computer to learn Mathematics.

The advantages of the questionnaire are:

- Copies of the questionnaire are easily distributed and less expensive. Explanation of purpose and identification and correction of any misunderstanding can be made.
- A questionnaire can be as brief as possible and have a response format that is easy and convenient for the respondent to complete.
- Copies of questionnaire are easy to administer.
- From the questionnaires the researcher can obtain information about the thoughts; feelings, attitude, beliefs, values, perceptions, personality and behavioural intentions of research participants (Johnson & Christensen, 2008:170).
- Closed - ended questions are easier and faster to tabulate also easy to calculate percentages and other hard statistical data.
- Open-ended questions enable participants to respond in any way they please.

The questionnaire in this study was easy to administer and allowed the researcher to gather information quicker.

The disadvantages of the questionnaire are:

- Closed-ended questions limit the breath of responses and number of participant that might take more time to construct their answers.
- A questionnaire requires a lot of time to designed and develop. To get the relevant answer; the questions should be carefully constructed.
- Questionnaires limit the scope of questioning.

In this study questionnaires were designed in such a way that learners and teachers were not struggling to give information needed, the questions were simple and straight to the point.

3.2.6 Document study

De Vos (2009:322) describes documents study as documents that are scrutinized and analyzed for the purposes of scientific research. There are two sources of document study: primary and secondary sources. According to De Vos (2009:322) primary sources are seen as the original written material of the authors own experiences and observation, while secondary sources consist of material that are derived from someone else as the original source. In this study primary sources were used, the examples from the following were utilized, official document, mass media and archival material.

3.2.6.1 Official documents

De Vos (2009:323) describes official documents as those documents that are compiled and maintained on a continuous basis by large organizations such as Government institutions. Examples of these documents are financial records, statistical reports, annual reports, progress records; bank statements etc. In this study annual and progress records were used. It is not easy to access official documents, a protocol has to be followed and this is time consuming.

3.2.6.2 Mass media

These are documents freely available to the public and thus to any individual (De Vos 2009:324). Printed and audio visual mass media include newspapers, journals, magazines and newsletters, television, radio, books etc. Mass media can be viewed as excellent sources of information De Vos (2009:324).In this study journal, books and newsletters are used.

3.2.6.3 Advantages of document study

According to (De Vos, 2009:325) advantages of documents are as follows:

- Relatively low cost - Depend on distance that need to be covered and availability of documents.
- Confession - According to De Vos, a person may be more likely to confess his/her secrets in a document.
- Non – reactivity-The contents of the documents are not affected by the activities of the researcher.
- Inaccessible subjects - The researcher does not to make personal contact with the respondent(s).

3.2.6.4 Disadvantages of document study

Document study has the following disadvantages:

- ✓ Incompleteness - Reports, statistical records and historical documents are often incomplete which means that there are gaps in the database.
- ✓ Bias - For example, autobiographies may be written with a view to making money.
- ✓ Lacks of availability - In some fields of study documents are simply not available because records were never kept. In other cases records were kept but inaccessible for security reasons. In this study some documents were inaccessible due to reasons beyond control.

3.3 TRUSTWORTHINESS OF THE STUDY

Mertler (2009:249) describes trustworthiness' as a verification of the consistency of various sources of qualitative data while accounting for their inherent biases. It focuses on the accuracy and believability of the data. In this study trustworthiness was established through internal validity and reliability.

3.3.1 Internal validity

Internal validity refers to the soundness or credibility of the study. Johnson and Christensen (2008:255) refer to internal validity as the ability to infer that a casual relationship exists between two variables. External validity refers to the circumstances under which the results of a study can be generalized to a population beyond the participants in the study. However in research studies there are threats to internal validity. Internal threats include History, Maturation, Instrumentation, Test practice and Differential selection.

3.3.1.1 Threats to internal validity

This section deals with the threats to internal validity of this research study.

3.1.1.1 History threat

History refers to an uncontrolled event that occurs during the study that may have an influence on the observed effect other than the variable under study (Drew, Hardman and Hosp, 2008:213). In this study the questionnaire was used and this threat did not occur.

3.3.1.1.2 Maturation threat

Maturation threat refers to the change during an intervention due to factors associated with the passing of time rather than to the intervention itself (Fraenkel and Wallen, 2008: 173). In this study the maturation threat did not exist since the questionnaires were applied once only.

3.3.1.1.3 Instrumentation threat

Instrumentation threat refers to bias stemming from the process of measurement in the research setting (Suter, 2006:171). In this research study there was no instrument change, hence this instrument threat was greatly reduced.

3.3.1.1.4 Testing threat

Testing refers to any change in scores obtained on the second administration of a test as a result of having previously taken the test (Johnson & Christensen, 2008:262). Since there were no pre-test and post-test in this study a testing threat did not exist.

3.3.1.1.5 Differential selection

Differential selection refers to the selecting of participants for the various treatment groups who have different characteristics (Johnson and Christensen, 2008:264). In this study secondary school mathematics teachers and learners were selected to be tested.

3.3.2 Reliability

Reliability refers to the consistency of the outcome measure or answers provided by an instrument. The internal consistency method of estimating reliability involves comparing responses to different sets of items that are part of an instrument (Fraenklen and Wallen, 2008:162).Ito ensure reliability in this research study the structure of the questions of the questionnaires were in a way such that they complement each other. In other words the questions were such that they inquire for one thing in a different way. If the participants of the questionnaires were consistent they may not give a 'yes' on one question then later give a 'no' on the same content but different question. Internal validity is said to exist when the responses of individuals are consistent throughout the questionnaire.

3.3.3 Data analysis strategy

This section deals with the triangulation of methods of this study.

3.3.3.1 Triangulation of methods

Triangulation refers to the interpretation of findings by mixing qualitative and quantitative styles of research and data (De Vos, 2009:341). In this study the use of multiple methods of data collection with a view to increasing the reliability of questionnaire were employed.

3.3.3.2 Advantages of triangulation of methods

Triangulation reduces the risk of chance associations and systematic bias and relies on information collected from a diverse range of individuals, teams and settings using a variety of methods (Maree, 2010:39).Triangulation can substantially increase credibility or trustworthiness of a research findings (Christensen & Johnson,2008:451).It allows researchers to be more confidence to their results. It plays many other constructive roles as well. It can stimulate the creation of inventive methods and new ways of capturing a problem to balance with conventional data collection methods (De Vos, 2009:342).

3.4 ETHICAL CONSIDERATION AND THE ROLE OF THE RESEARCHER

The researcher requested permission letter from the school of postgraduate studies, to conduct research .The researcher took the letter to the Area Project Manager in Mafikeng Office, to ask permission to conduct research in the schools in Mafikeng area. Permission was granted. The researcher communicated with teachers who are teaching Mathematics and learners from sampled schools. Some teachers were telephonically contacted others personally. The researcher requested teachers to ask learners to volunteer to participate in the study.

The researcher received verbal consent from the volunteers before giving away the questionnaire. The researcher assured participants that, all information and responses shared

during the study would be kept private and the results would be presented in an anonymous manner, in order to protect the identities of the participants.

3.5 SUMMARY

The researcher used the quantitative approach, survey method and instruments such as questionnaire were used. A triangulation method for collecting data to achieve reliability and validity was also used in this study. This chapter has outlined the methodology or procedures used in this research. Aspects discussed in this chapter were quantitative approach, population and sample, survey research method, questionnaire and document analysis as research instruments in order to achieve validity and reliability.

Chapter 4 deals with the analysis of the research findings

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

4.1 INTRODUCTION

This research is about using computers in the teaching and learning of Mathematics. In this chapter, the researcher reports on the findings in the use of the computers in the teaching and learning Mathematics in the senior secondary schools around Mafikeng Area Project Office. Triangulation method was used to collect data." It is a process of relating multiple sources of data in order to establish their trustworthiness or verification of the consistency of the facts while trying to account for their inherent biases" (Mertler, 2009:11). Questionnaires for teachers and learners were used. The researcher findings are presented in the form of tables, bar graphs and pie charts. A brief discussion accompanies each illustration given in the analysis. This section deals with how the data collected were analysed. All the data which were presented in the form of tables and expressed as percentages.

4.2 Analysis of learners' responses

With regard to the demographic characteristics of the respondents, there were two types of respondents involved in the research study, namely, learners and teachers.

4.2.1 Demographic characteristics of learners

The sample for learners in this study was drawn from 20 senior secondary school in Mafikeng Area Project Office. A total of 60 learners successfully completed the designed questionnaire. The following table gives the general demographic characteristics of the learners who took part in the research study.

Table 4.1: Gender distribution of learners

GENDER	FREQUENCY(F)	PERCENTAGES (%)
Male	120	40
Female	180	60
Total	300	100

Table 4.1 illustrates that majority of learners who took part in this research 60% are female and 40% male. Which means in this survey, more female learners were involved compared to male learners.

Table 4.2: Age distribution of learners

AGE	FREQUENCY	PERCENTAGES
15-17 yrs	129	43
17+	171	57
Total	300	100

The above table shows that learners who participated in this research, most of learners are above 17 years old; which means that learners who are doing Mathematics in senior secondary school are 17 years and above. Most of the learners in Senior Secondary Schools can be ready to use computers, concepts and manipulation might not be a problem.

Fig 4.1: Learners with computers at home and number of learners that have computers at school

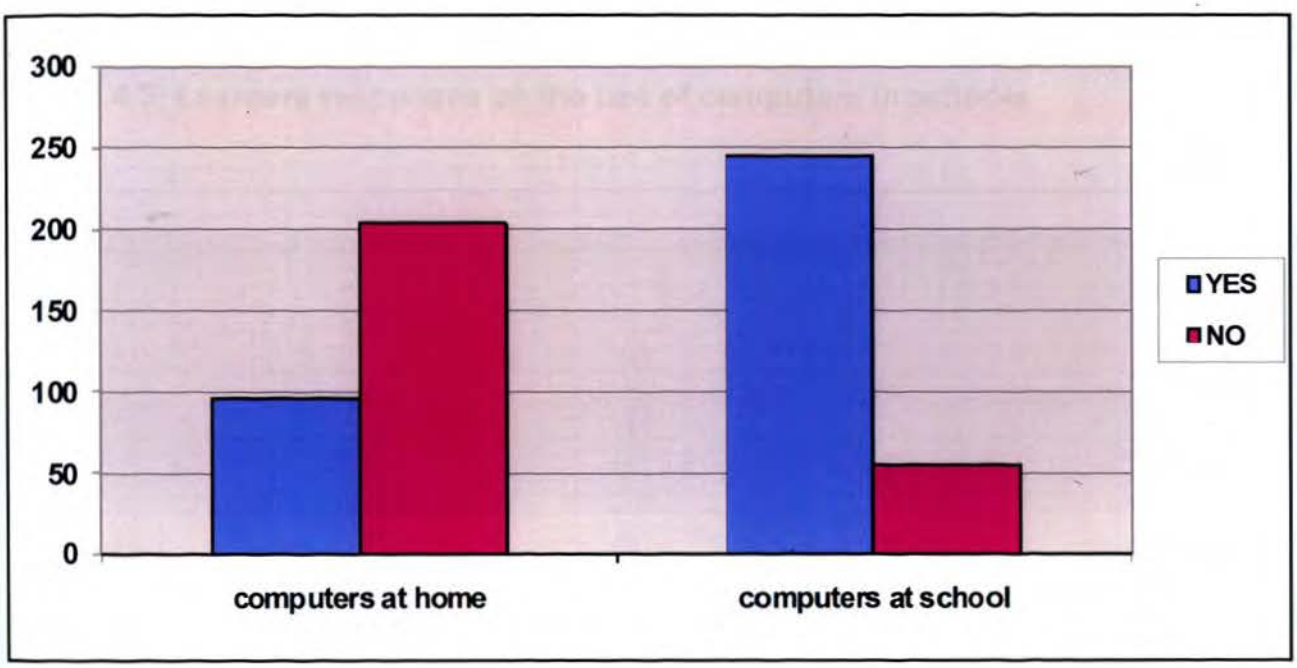


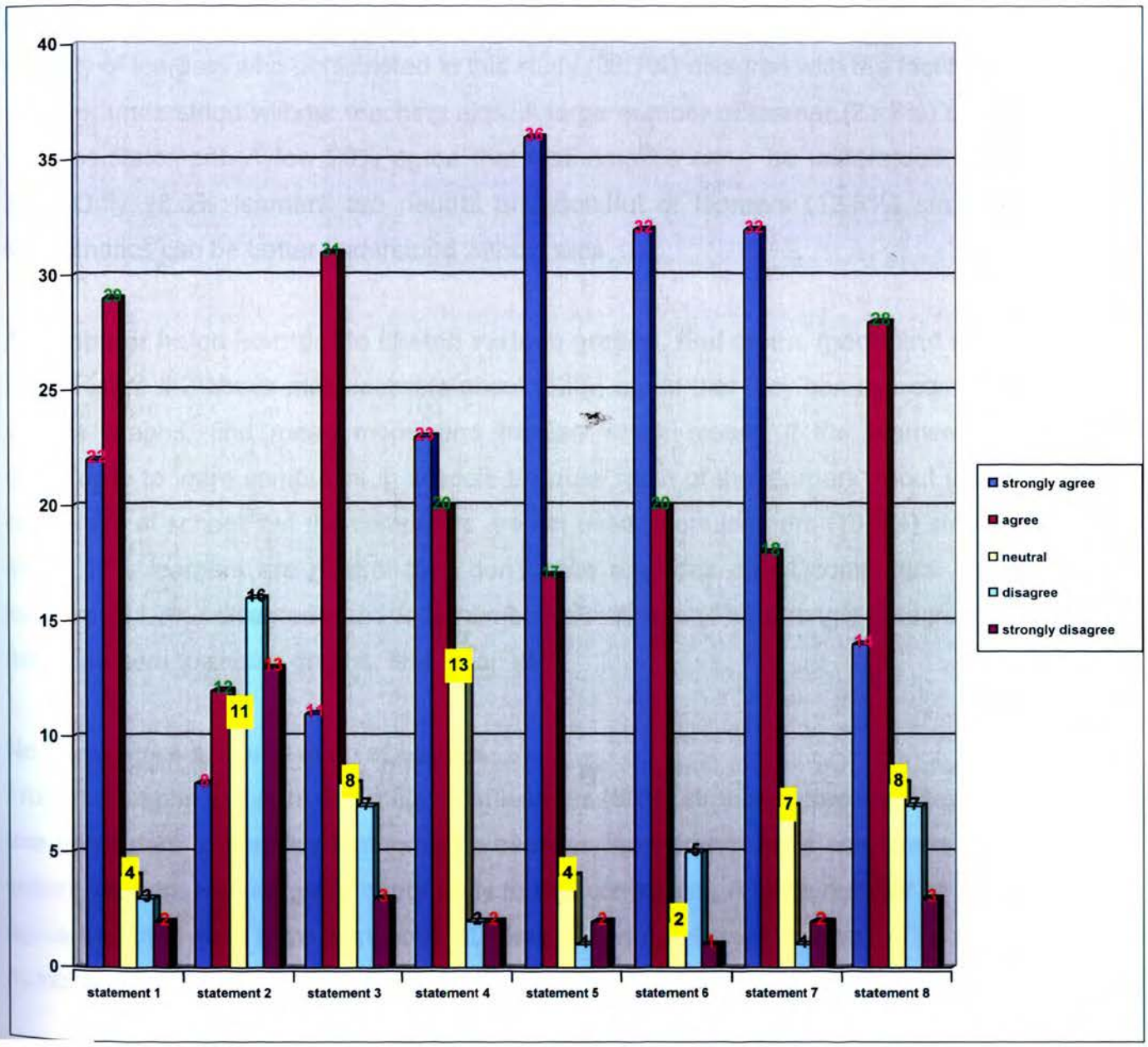
Figure 4.1 shows that out of 300 learners, 204 learners (68%) had no computers at home and only 96 learners (32%) had a computer at home, which means that families of these learners don't have computers at home, which might be a problem to teachers to use computers at schools. Again 246 learners (82%) had computers at schools but 55 learners (18%) do not have computers at their schools. According to the information, most schools are having computers. Are these computers working or just school property?

4.2.2 Learners' responses

SECTION B

This section aims at getting information from learners about their perception on the use of computers in the learning of Mathematics

Figure: 4.2: Learners responses on the use of computers in schools



Importance of computer in the teaching and learning Mathematics.

In this statement, 29 learners out of 60 (48%) [144 out of 300] strongly agree that computers can be used to learn Mathematics. Only 22 learners out of 60 (36.6%) [110 out of 300] agreed that computers are an important tool in the learning of Mathematics. A small fraction of 5 out of 60 (8.3%) [25 out of 300] disagree that computers are an important tool for the teaching and learning Mathematics. A handful learners about (7.1%) [21 out of 300] is neutral on that aspect.

Mathematics can be better understood without teaching aids.

Majority of learners who participated in this study (26.7%) disagree with the fact that Mathematics is better understood without teaching aids. A large number of learner (21.7%) strongly disagree with the statement. A few 20% agree that Mathematics can be understood without teaching aids. Only 18.3% learners are neutral and handful of learners (13.3%) strongly agree that Mathematics can be better understood without aids.

A computer helps learners to sketch various graphs, find mean, mode and median.

From Figure 4.2 above most learners about (52%) agree that they can use computers to sketch various graphs, find mean mode and median which means if the learners can be given opportunity to learn computers in schools because most of the learners about (82%) are having computers at school, but the computers are not used. More learners (18.3%) strongly agree and about 13% learners are neutral they don't have any idea about computers. Little number of learners (11.7%) disagrees and less number of learners (5%) strongly disagree that computer helps learners to sketch graphs, find mean etc.

No computers at home even at school.

From the graphs in Figure 4.2, majority of learners (60%) strongly agree that they find it difficult to use computers in learning Mathematics because they do not have computers at home and at school learners are not given opportunity to use computers. A large number of learners (28.3%) agree that they don't have computers at home. A few numbers of learners (7%) are neutral. Less number of learners (3%) strongly disagree that they have computers at home and at school to

learn Mathematics. A small fraction of learners (1.7%) disagree that they are having computers at home and at school and opportunity is given to them to learn Mathematics.

Learners use Mathematical Programmes.

From the graph figure 4.2, it shows that most learners about (47%) agree that they do not use Mathematical programmes on the computer because to operate a computer is a challenge to them. More learners (23%) strongly agree that they do not use Mathematical programmes to learn Mathematical concepts. Few learners about (13%) are neutral, have no idea about Mathematical programmes on the computer. Only 12% of learners disagree that they use Mathematical programmes to learn Mathematics. A small portion 5% of learners also strongly agrees that they use mathematical programmes on the computers to learn Mathematics.

4.3. ANALYSIS OF TEACHERS QUESTIONNAIRE

Table 4.3: School enrolment

SCHOOL ENROLMENT	FREQUENCY	PERCENTAGES
100-250	2	5
250-350	5	12,5
350-450	4	10
450+	29	72,5
Total	40	100

From Table 4.3, it shows that most teachers (72.5%) in the Mafikeng Project Office are teaching in schools with enrolment of more than 450 learners. Few teachers about (5%) are teaching in a school with enrolment of between 100-250 learners. About 12, 5% of teachers are in schools with enrolment of between 350-450 learners. Lastly 10% of teachers are in schools of between 350-450 learners.

Table 4.4: Teachers qualifications

QUALIFICATION	FREQUENCY	PERCENTAGES (%)
Matric + ACE	2	5
UDE(P/S)	4	10
Higher Education Diploma	4	10
Degree in Education	21	52.5
Honours Degree	9	22.5
Masters Degree	0	0
Ph Degree	0	0
Total	40	100

According to the information in the Table 4.4 above, majority of teachers (52,5%) who participated in this research are qualified with Degree in Education. According to Department of Education teachers with Degree in Education are not under qualified teachers. Teachers who have Matric and Diploma in Education are about 15%.Teachers are qualified but they have limited knowledge about the usage of computer in the teaching of Mathematics and teachers have not been trained on how to use computers in their teaching and these disadvantage teachers and learners.

Table 4.5: Age distribution of teachers

AGE IN YEARS	FREQUENCY	PERCENTAGES (%)
20-29	7	17.5
30-39	26	65.0
40-49	5	12.5
50-59	2	5.0
60+	0	0
Total	40	100

Table 4.5 shows that of teachers who participated in this investigation (65%) of them are between 30-39.About 5% teachers are between 50-59.Only 17.5% of teachers teaching Mathematics are between 20-29 years old and those that are between 40-49 are only (12.5%) .

Tab le 4.6: Current position of teachers

POSITION	FREQUENCY	PERCENTAGES
Teacher	33	82,5
Head of Department	7	17,5
Deputy principal	0	0
Principal	0	0
Total	40	100

Table 4.6 clearly shows that deputy principals and principals who participated in this study do not teach Mathematics and a bigger number of 82, 5% of teachers who participated in this study are teaching Mathematics. A small number of head of Department (17.5%) showed that they are teaching Mathematics.

Table 4.7: Teachers teaching experience

NO.OF YEARS	FREQUENCY	PERCENTAGES
0-5	9	22,5
6-10	11	27,5
11-15	11	27,5
16-20	5	12.5
20+	4	10.0
Total	40	100

An analysis of the years of teaching experience indicates that most of the teachers have ten years or more experience in teaching. A majority of teachers (27.5%) who teach Mathematics are in the range of 6-15 yrs experience. Teachers with 16-20 years teaching experience are 5, which

is (12.5%). Above 20 years they are 4, which is (10%). And those between 0-5 yrs experience are 9, which is (22, 5%) of the total teachers participated in this research. It shows that teachers have a vast experience of teaching Mathematics. But this experience is not refer to the Mathematics because some of them have being teaching Mathematics in Middle and in low grades, due to the Government redeployment they are now teaching in secondary schools.

Table 4.8: Subject taught

SUBJECT	FREQUENCY	PERCENTAGES
Mathematics	40	100
Computer	0	0
Total	40	100

The above Table 4.8 shows that 40 of the teachers (100%) are teaching Mathematics and none are teaching Computer.

Table 4.9: Number of computers in schools

NUMBER OF COMPUTERS	FREQUENCY	PERCENTAGES
0-5	6	15
6-10	3	7,5
11-15	5	12,5
16-20	7	17,5
20+	19	47,5
Total	40	100

Table 4.9 indicates that 19 teachers (47, 5 %) who participated in this study are having 20 and more computers in their schools. About 7 teachers (17.5%) are having 16-20 computers in the school, whereas 6 of the teachers (15%) are having between 0-5 computers at school. Only 5 teachers (12.5%) are having between 11-15 computers at school. Minority teachers (7.5%) are only having 6-10 computers at school.

Table 4.10: Teacher – learner ratio

LEARNER-RATIO	FREQUENCY	PERCENTAGES
20-30	1	2.5
31-40	20	50
41-50	16	40
51-60	3	7.5
61+	0	0
Total	40	100

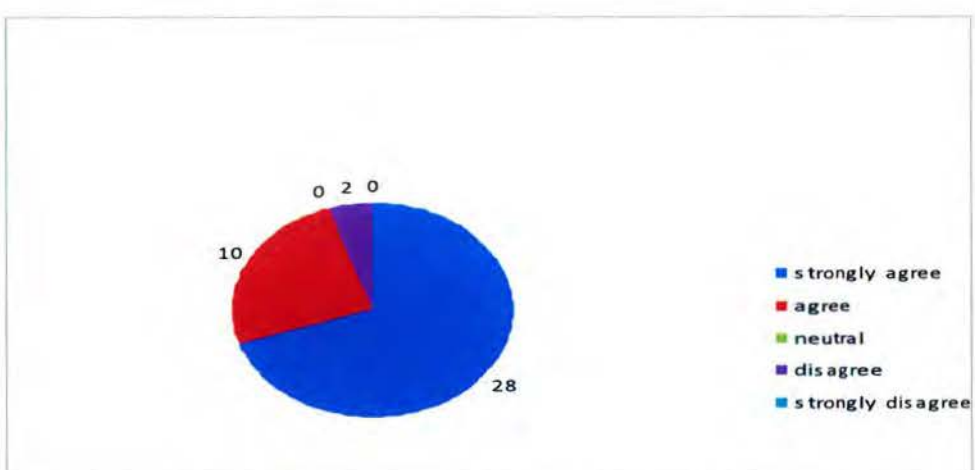
Table 4.10 shows half of the teachers (50%) are teaching classes with 31-40 learners in the classroom. About 40% of the teachers are teaching learners between 41-50 in the classroom, less 2.5% of teachers are teaching learners between 20-30 in the class. Few teachers about (7.5%) are teaching between 51-60 learners in one classroom.

4.3.1. Section B

This section aims at getting information from teachers about their perception in the use of computers in the teaching of Mathematics

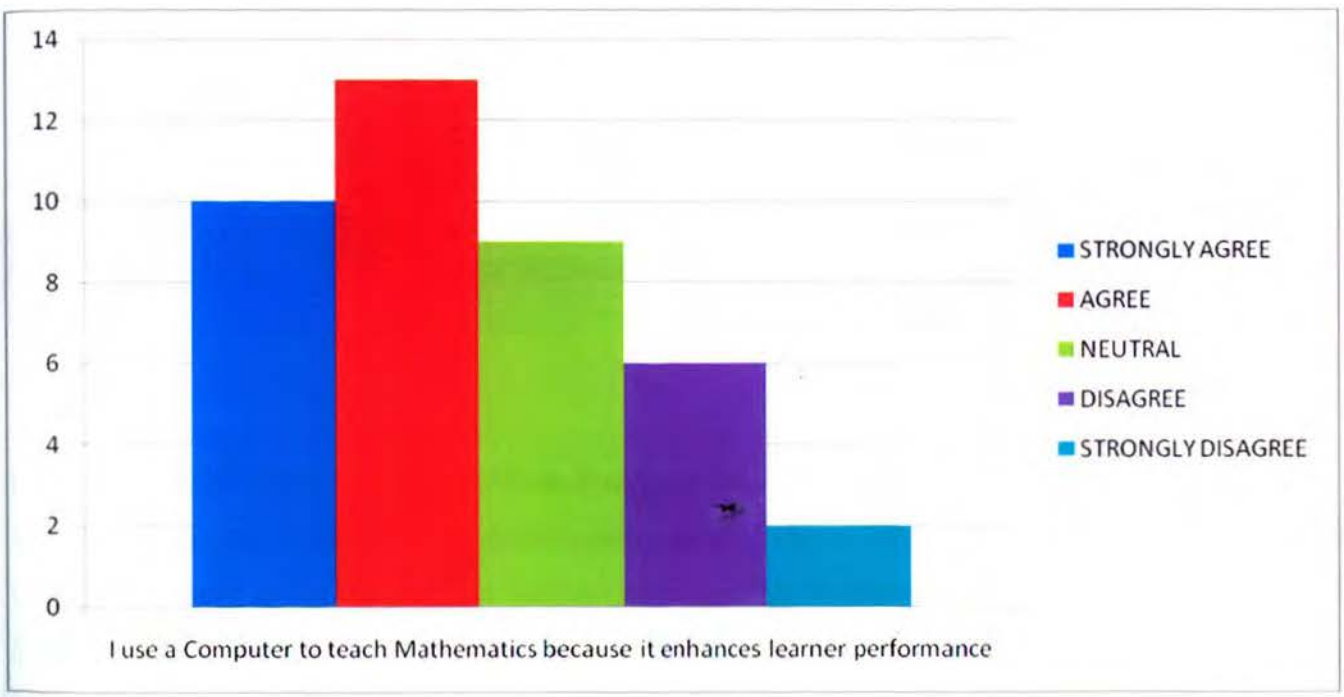
4.3.1.1. A computer is an important tool for the teaching mathematics

Figure. 4. 3: The importance of the computer



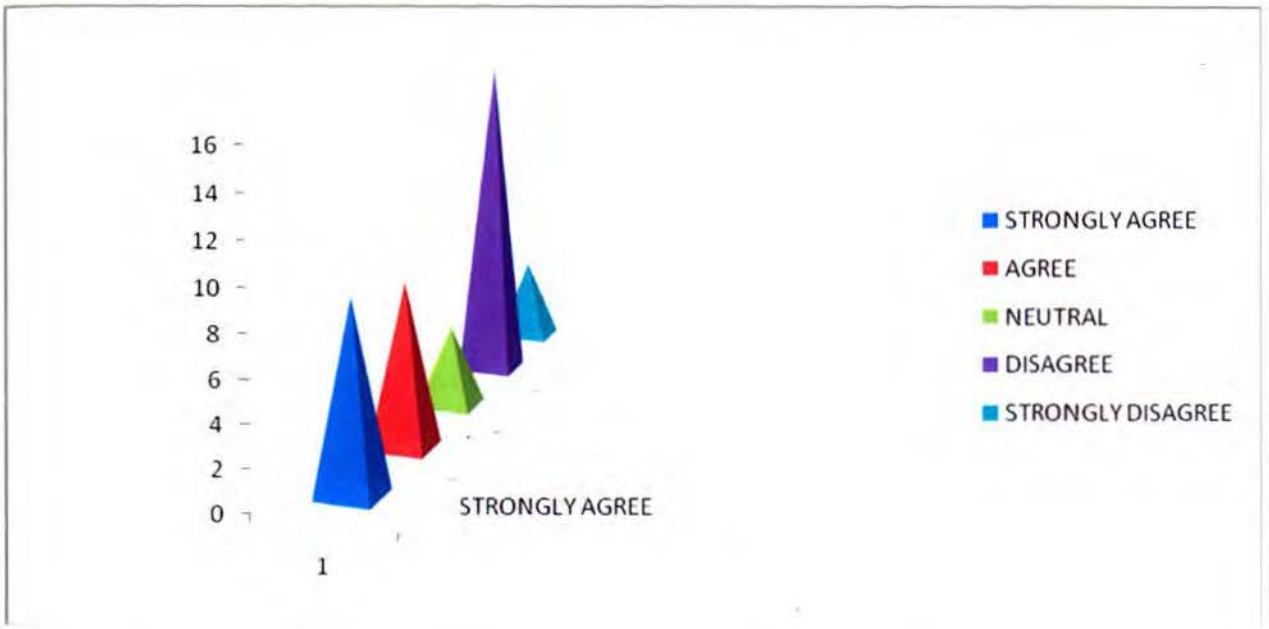
From the pie chart drawn 28 out of 40 which is (70%) of teachers indicated that using computers for the teaching Mathematics is important in Senior Secondary Schools. About 10 teachers, which are (25%), agree on the fact that computers are important in teaching Mathematics. Only 2 teachers out of 40 (5%) did not agree that computers are important in teaching Mathematics.

Figure 4.4: The use of a computer to teach Mathematics enhances leaner performance



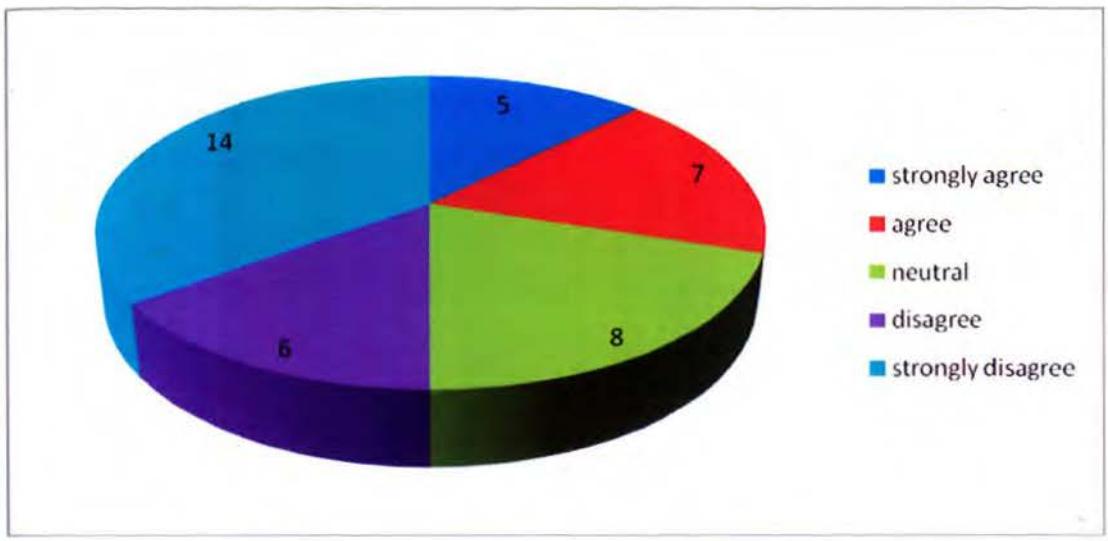
From the above bar graph, Figure 4.4, most teachers (32.5%) agree that computers enhance learner performance. About 25% teachers also strongly agree that the use of computers in teaching Mathematics can enhance learner performances. Only 22.5% teachers are neutral. Few teachers (15%) disagree that using computers in the teaching of Mathematics enhances learners' performance. The least teachers (5%) strongly disagree that computers enhances learners' performance.

Figure 4.5: Computers make learners perform Mathematical calculations and draw graphs easily.



From the above graph 39% of teachers disagree that computers make learners perform Mathematical calculations and to draw graphs easily. About 24% of teachers strongly agree that using computers in the teaching of Mathematics can make learners perform mathematical skills. Also 19% of teachers agree that computers make learners to perform mathematical skills. Only 10% of teachers are neutral and minority (8%) also strongly disagreeing that using computers in teaching Mathematics make learners perform mathematical skills.

Figure 4.6: There is enough software which can be used to teach Mathematics



From the pie chart it is evident that 35% of teachers strongly disagree that there is enough software which can be used to teach Mathematics. A large number of teachers (20%) are neutral. About 17.5% agree that there is enough software in schools which can be used by learners and teachers in the teaching and learning of Mathematics Few teachers (15%) disagree that there is enough software in schools. Only 12.5% teachers strongly agree that there is enough software for Mathematics teaching and learning in schools.

Figure 4.7: Summary of statement 15 and 16

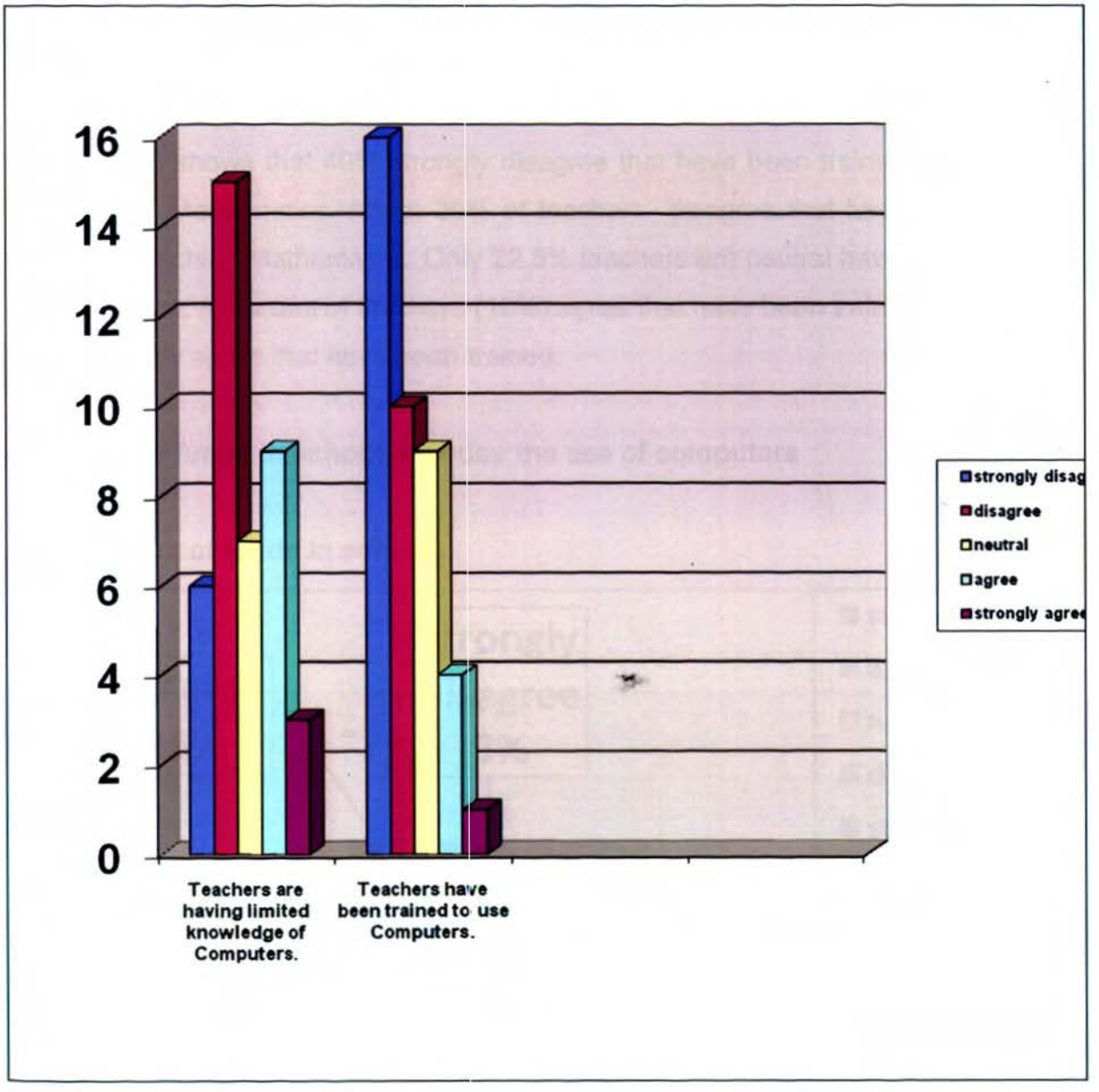


Figure 4.7, shows that 37.5% of teachers disagreed that are having limited knowledge of computers. About 22.5% agree that are having limited knowledge of computers. Few 17.5% teachers are neutral. Only 15% of teachers strongly disagree that are having limited knowledge of computers hence they are not using them in their lessons. Lastly about 7.5% strongly agree that are having limited knowledge of computers.

Figure 4.7, also shows that 40% strongly disagree that have been trained to use computers for the teaching of Mathematics. About 25% of teachers disagree that have been trained to use computer for teaching Mathematics. Only 22.5% teachers are neutral have no idea about training to use computers. A handful of teachers (10%) agree that have been trained for using computers, but 2.5% strongly agree that have been trained.

4.3.1.2. Lack of funds in school impedes the use of computers

Figure 4.8: Lack of funds in schools

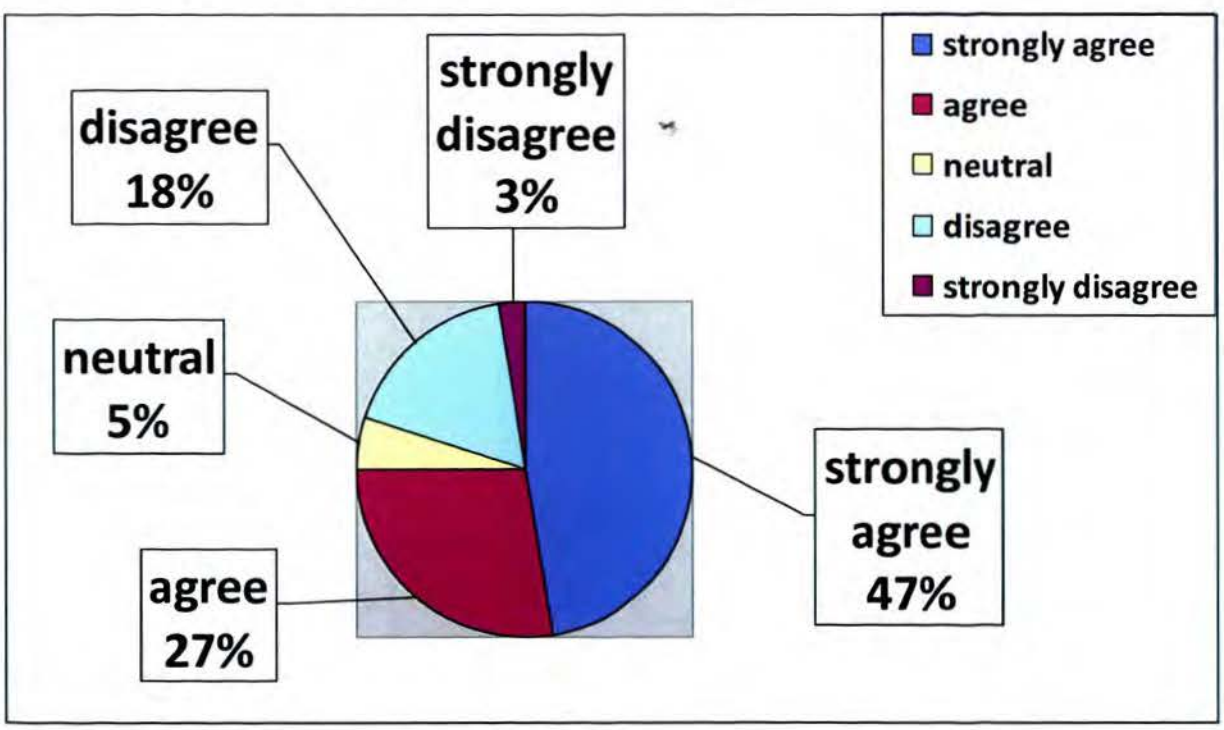


Figure 4.8 indicates that 47% of teachers strongly agreed that schools are lacking funds so it is difficult to have or use the computers in the teaching and learning Mathematics. About 27% of teachers agree that lack of funds in schools impedes the use of computers. Only 18% of teachers disagree that funds in schools impedes the use of computers. About 5% of teachers are neutral and 3% of teachers strongly disagree that lack of funds in schools impedes the use of computers.

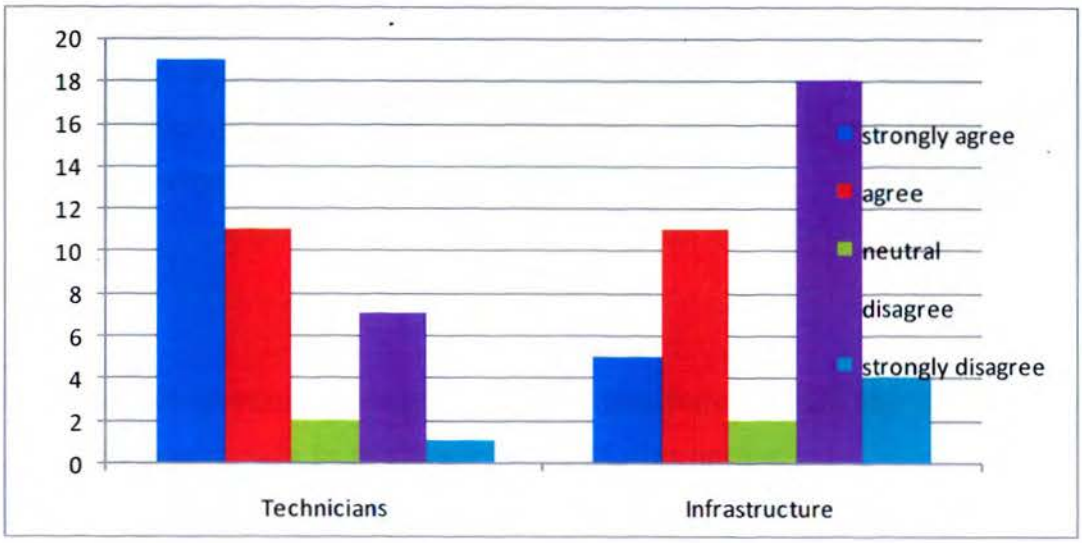
4.3.1.3. Technicians

Figure 4.9 below shows that 47.5% strongly agree that the technicians are not available in schools for the maintenance of computers. Also 27.5% of teachers agreed that technicians are not always there for computer services. Only 17.5% of teachers disagree that technicians are there all the time. About 5% of teachers are neutral and only 2.5% strongly disagree that technician are available.

4.3.1.4. Infrastructure

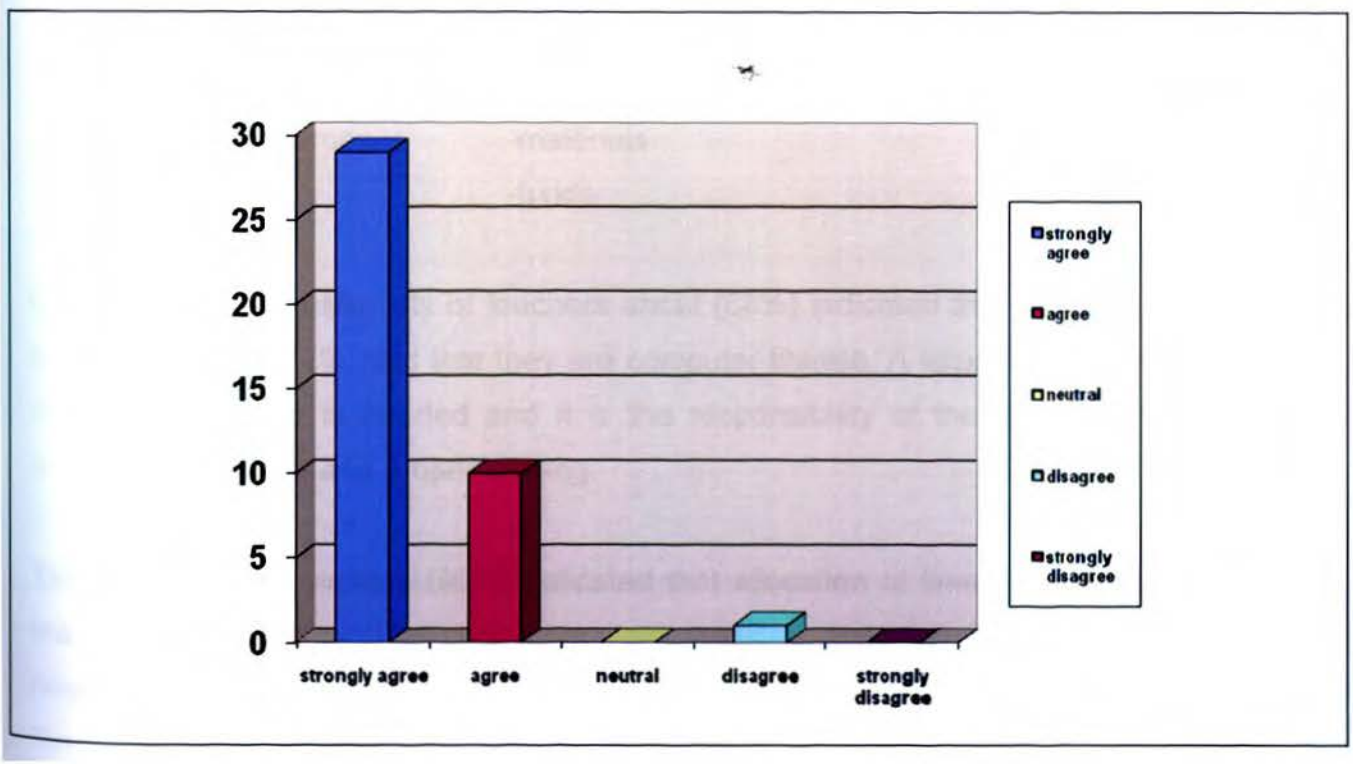
Figure 4.9 below also shows that 45% of teachers who participated in this study strongly disagree that resources are available in schools for computer materials. About 27.5% of teachers agree that resources are enough in schools for using computers in Mathematics teaching. Only 12.5% of teachers strongly agree that resources are available. About 10% of teachers strongly disagree that infrastructure is limited and it impedes the use of computers. Only 5% of teachers are neutral on this aspect.

Figure 4. 9: Technicians and infrastructure



4.3.1.5. Workshops are needed

Figure 4.10: Training and workshops



From Figure 4.10 the indication is that 72.5% of teachers strongly agree that workshops are needed for training of teachers on how to use computers in the teaching of Mathematics. About 25% of teachers also agreed that workshops are needed and it is the responsibility of the Department of Education to organise the training. Only 2.5% of teachers disagree that training is necessary for using computers in the teaching of Mathematics.

4.4. Section C

This section aims at getting information from teachers about the challenges they are facing when using computers in the teaching of Mathematics

4.4.1. Challenges that are faced by teachers are classified according to the following categories:

- Computer literacy
- Time
- Mathematical Software
- Resources -materials
  -funds

Computer literacy: Majority of teachers about (88%) indicated that they do not have computer skills. Only a few 12% said that they are computer literate. A large number of teachers (72.5%) stated that training is needed and it is the responsibility of the Department of Education to organise workshops and proper training.

Time: Majority of teachers (95%) indicated that allocation of time in their schools is limited for teaching Mathematics. The classrooms are crowded, teaching Mathematics using computers need individual attention and it is not possible for teachers to meet individual learner's needs. Time allocation for teaching Mathematics using computers need to be revised because Mathematics is allocated only 4 hours and 30 minutes per week.

Mathematical Software: Mathematical software and hardware also bring a challenge to teachers. A large number of teachers (70%) indicated that to teach Mathematics without skill without computer software is too easy. A few teachers (30%) said using computers in the classroom can makes the lesson simple only if learners are few because they need individual attention. Most teachers said computers are not updated they are not inline with the current syllabi, for those who can use them they only manage to record learners marks and set Mathematics question papers and save them. Teachers believe that engaging learners and allowing them to discover things can make learners to focus on their work Teachers and learners has no access to internet in most schools. Using computers in the teaching of Mathematics need a lot of time and courage.

- **Resources:** Majority of teachers (87%) indicated that resources such as infrastructure, technicians are not available. A few teachers (13%) who have computers said that computer laboratory is used very minimally and in most instances it is used for meetings and other purposes other than teaching and learning. Funds are also problems to most schools. A large number of teachers (42%) indicated that lack of funds in the schools make it difficult for them to repair and maintain computers. Majority of teachers (53%) said that their schools are classified as no fee schools and there are no funds to purchase computers. A few 5% of teachers indicated that their schools only manage to purchase two or three computers for administration purposes since the funds are not enough to purchase more computers and to maintain them.

4.4. SUMMARY

In this chapter a summary of the data collected was presented. The findings of this study were also presented. From the findings, it can be concluded that computer technology is not used in Mathematics teaching and learning in schools around Mafikeng Area Project Offices This chapter has shown that teachers and learners in Mafikeng area have very strong positive perception about the use of computers in the teaching and learning of Mathematics even though the resources are not available

It can also conclude from the findings that most teachers and learners are computer literate. Teachers are not trained on using computers for teaching Mathematics.

The next chapter deals with syntheses, discussion of findings and recommendations.

CHAPTER FIVE

SYNTHESES, DISCUSSION OF FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

This is the final chapter of this dissertation and it focuses on the following themes: - the main research findings, report on the research hypotheses and research recommendations.

5.2 SUMMARY OF THE WHOLE STUDY

Chapter 1 provided a general overview to the study, including an introduction and rationale for the study. This chapter also contain the research problem, research hypotheses, and purpose of the study, limitations and delimitation and definition of main concepts.

Chapter 2 is literature review or conceptual framework, it outlined the conceptual framework for the study by providing a literature exploration with regard to information on the use of computer as a tool for the teaching and learning of Mathematics, attitude of learners and teachers towards computer usage, as well as challenges that teachers and learners are facing when using computers.

Chapter 3 describes the research process in depth, including the research design and methodology followed in the study.

Chapter 4 dealt with the analysis of the data and the findings of the study. Results were presented in accordance with survey, literature study and document analysis.

In chapter 5 the researcher summarises the results of the study and presents conclusion drawn from the study. Limitations and recommendations are discussed.

5.3 RESEARCH FINDINGS

Data collection gave rise to a number of findings related and unrelated to this dissertation. Related data helped with the testing of the research problem and more importantly, research hypotheses.

The research aim was to investigate the use of computers in the teaching and learning of Mathematics in Senior Secondary Schools around Mafikeng Area Project Office. The research findings were intended to provide solution to the following research hypotheses:

- ❖ Skills and concepts are enhanced when teachers use computers technology during lesson presentation of Mathematics.
- ❖ Poor computer literacy level of teachers and learners inhibits the use of computers in the teaching and learning process of Mathematics.
- ❖ Computers are not effectively used as aid in the teaching and learning of Mathematics.
- ❖ The lack of software and hardware in senior secondary schools in MAPO results in computers being used for administration purposes only.

5.3.1 Findings from literature study

Ittingson & Zewe (2003:106) conducted the research on technology in the Mathematics classroom at New York in 2003. Ittingson & Zewe (2003:205) found out that computer technology is important in the teaching and learning of Mathematics. They also found out that using computer in the classroom, allows a learner to focus on strategies and interpretation of answers. Mistretta (2005:233) found the benefits of using Mathematics software when using computer, for example, learners are able to collect and analyse data. Database and spreadsheets give learners confidence of analysing large amounts of data accurately.

Pudi (2007:116) recommended that the importance of computer technology in promoting Mathematical and scientific knowledge must be instilled in the teachers and learners. He also stresses that for effective use of computers in the teaching and learning Mathematics, schools must make certain that, teachers have the necessary skills and knowledge to effectively model and teach exemplary uses of technology.

Valdez (2005:7) indicated that computer technology use can be very beneficial to increase educational productivity. Valdez (2005:8) noted that instructional technology is recognised as a powerful means to boost student achievement. Moila (2006:70) in his investigation on the use of educational technology in Mathematics teaching and learning in South Africa rural Secondary Schools, noted that, information communication technology tools are not used in Mathematics teaching and learning, inadequate training of teachers on information communication technology usage in teaching and learning and lack of relevant tools for rural schools.

Taft (2000:289) indicated that computers are training tools, research tools, intellectual development and communication tools. Afshari et al (2009:12) carried out a study examining teachers' characteristics (e.g., age; gender; experience) and attitude towards the use of computers in their classrooms. The report indicated that teachers with fewer years of experience were more likely to use computers in their classes than teachers with more years of successful use of technology in classroom depends to a large extent on the teachers' attitudes towards these tools. It has been suggested that attitudes towards computers affect teachers' use of computers in the classroom and likelihood of their benefiting from training.

Valdez (2005:7) in his study," technology: a catalyst for teaching and learning in the classroom," stated the factors affecting the use of computer in the classroom as follows: Lack of technology infrastructure, teachers discomfort with technology, lack of learner technology skills etc .Herselman, (2003:400) in his study, also identified challenges that schools encountered in their usage of computer in South Africa, they include lack of buildings, stationery, lack of experience and skilled teachers. He also reported that large number of teachers –learner ratio and lack of electricity connection .Rose - Innes (2007), identified that in Kenya the use of computer is costly

because Kenya has 20 000 schools and to purchase, install, maintain and connect internet is a heavy burden to the Kenya government and schools budget.

5.3.2 Findings from the empirical research

From the research findings the following were concluded:

- Majority of teachers (70%) and (48%) of learners, see computers as an important aid in the teaching and learning of Mathematics. A large number of learners (52%) believe that using computers to learn, can help them to understand Mathematical concepts better. Most teachers about (60%) also believe that using computers can enhance learner performance.

- Majority of teachers (88%) indicated that they don't have computer skills and to teach Mathematics using computer is a challenge hence most of teachers are having negative attitude towards the use of computers. About (65%) of teachers said they have not been trained to use computers to teach Mathematics. A large number of learners (47%) said that they do not use Mathematical programmes on the computers because to operate the computer is a challenge to them. Learners are computer literate .About 68% of learners do not have computers at home

- .A large number of teachers (35%) indicated that mathematical software are not enough, a few 2.5% mentioned that the computers are few and their schools use them for administration purposes only. Majority of teachers (62,5%)indicated that computers are not updated with the mathematical programmes those that are using computers is for recording of the learners marks and to set Mathematics question papers.

- Majority of learners (82%) said they have computers at their schools and they are not given opportunity to operate them. About 47.5%of teachers also indicated that there are more than 20 computers at their schools but they are not effectively used. Computer centre are used for meeting and other purposes. Computers are school property and just

white elephant, accumulating dust because teachers are computer literate. In most schools electricity is unstable and these contribute to the ineffective use of computers in the teaching and learning Mathematics. Computers serve as communication tool whereby learners can communicate through different network levels that are available.

- Teachers' attitudes towards the use of computer contribute to the ineffective use of computers in the teaching and learning of Mathematics. A large number of teachers (50%) said that it is difficult to use computers effectively in the classroom because classrooms are overcrowded and most teachers about (47.5%) that have more than 20 computers at schools said computers are not enough for their learners.

- A large number of teachers (65%) indicated that resources such computer laboratory, computer materials and internet are not available in their schools Learners are unable to access information from online resources. Computer tools such as CD-ROMs and memory sticks are not accessible for teachers and learners. A few teachers (35%) who sometimes use computers during their lesson said that, the materials they are using are for their personal use.

5.3.3 Correlation of findings from the literature study and findings from the empirical research

De Vos, (2009:243) stated that correlation is concerned with describing the degree of relation between (two) variables (where prediction is concern with estimating one variable from knowledge of another. In this study there is a correlation between literature study and empirical research.

From the findings 52%of learners indicated that using computers in the learning of Mathematics help them to workout Mathematical problems, also to sketch various graphs, to find mean, mode and mean can be very simple and faster. Learners also believe that using computer in class help them to explain Mathematical concepts. Pudi (2007:64), indicated that using computers in the teaching and learning of Mathematics serves as a communication medium .Technological

concepts such as graphs and formulae are conveyed through Mathematical symbols. Valdez (2005:7) also said that using computers in Mathematics teaching give learners access information from internet and use to communicate findings to others by using graphs, illustrations and animations as well as to stimulate and solve real problems. Taft (2000:289) indicated that computers are training tools, research tools, intellectual development and communication tools. This confirms the hypotheses that skills and concepts are enhanced when teachers use computers technology during lesson presentation of Mathematics.

From the findings majority of teachers (88%) indicated that they lack computer skills therefore it is difficult for them to use computer in teaching of Mathematics. Learners also (47%) said they cannot use computers because they find it difficult to operate and majority of them (60%) are not having computers at home. Valdez (2005:7) stated that factors that affect the use of computers in the teaching and learning Mathematics in the classroom are: Lack of learner technology skills, teachers discomfort with technology and lack of technology facilities .Herselman (2003:400) identified challenges that schools encountered in the usage of computers in South Africa, they include lack of experience and skilled teachers Moila,(2006:70) reported that teachers are not trained on how to use technological tools for the teaching and learning Mathematics This confirm the hypotheses that the poor computer literacy level of teachers and learners inhibits the use of computers in the teaching and learning of Mathematics..

The study found out that 70% of teachers considers computers as an important tool to be used in the teaching of Mathematics. A large number of learners (85%) indicated that computers are important aid to be used in the learning of Mathematics in schools Even though computers are important, the problem is, computers are not effectively used. About 82% learners said computers are available at their schools but they are not given opportunity to use them because their teachers too are computer literate. About 65% of teachers indicated that computer resources are not enough for using computer in the teaching of Mathematics. Teachers (53%) indicated that lack of funds in schools enable them to use computers effectively because most of teachers said their schools are classified said no fee schools.

Herselman (2003:57) indicated that lack of buildings, stationery and lack of experienced teachers contributed to ineffective use of computers in the teaching of Mathematics. He also identified the issue of teacher-learner ratio and lack of electricity connections. Valdez (2005:7) also reported that lack of technology infrastructure inhibits the effective use of computers in the classroom. Adekomi (2001:5) mentioned that using computers in the teaching and learning of Mathematics because the sophistication in construction and operations in most of the equipment, the absence of adequately trained staff for maintenance and repair. That also confirms the hypotheses that computers are not effectively used as aid in the teaching and learning of Mathematics.

From the research findings majority of teachers (63%) indicated that computers in that computers at their school are not updated with mathematical programmes. Computer software and hardware are not enough. About (47%) of teachers said that their schools lack funds. It difficult for the schools to purchase more computers or to update them because of lack of funds. Few schools have computers that are donated from private sector in the Northwest Province. About (65%) teachers indicated that computer resources are a challenge in the using of computers to teach Mathematics. Computer stationery such as CD-ROMs is not affordable by the schools because of lack of funds hence in other schools computers are used for administration purposes only.

Provenzo (2005:96) indicated that software are the most widespread and versatile use of the computer in Education.Mistretta (2005:23) found the benefits of using Mathematical software when using computer for example, learners are able to collect and analyse data. Database and widespread sheets give learners confidence of analysing large amounts of data accurately. Oldknow &Taylor (2002:107) indicated that computer offers young children the ability to explore and solve problems involving large numbers at an early age, investigate characteristics of shapes using dynamic geometry software and organise large sets of data. This confirms the hypotheses that lack of software and hardware in senior secondary schools results in computers being used for administration purposes only.

5.4 RECOMMENDATIONS

The following recommendations are made as a result of the finding of this research:

- Teachers need to articulate how to use computers to fit into the Mathematics curriculum.
- Teachers are supposed to come up with correct and appropriate procedures and policies for working with computer technology tools in a group situation.
- Teacher training institutions are playing a crucial role for any change in the educational system. Therefore, the partnership between schools and teacher training institutions should be encouraged. Such partnerships should be fostered throughout the whole educational system.
- On-going in service teacher training is a key issue for successful computer usage in the teaching and learning of Mathematics. Practice makes perfect.
- As mentioned earlier, these training activities could be implemented within the framework of partnership with the teacher training institutions.
- Involving teacher training institutions and teachers in policy activities. Teacher training institutions not only have the obvious task of training teachers they also need to be involved in influencing curriculum change, software development and creating supplementary educational materials research.
- The Department of Education should address the challenges faced by teachers and learners in the usage of the computers in the teaching and learning of Mathematics.
- The Department of Education should revisit Mafikeng Area Project Office budget and consider the importance of organising workshops, training of teachers, development of infrastructure as well as updating computers with the necessary software and hardware.
- It is also important to redirect financial resources so that schools can purchase and employ people who can facilitate computer lessons for teachers and learners.

5.5 LIMITATIONS OF THE STUDY

The following were identifiable research limitations within which the study was conducted:

- The researcher was not directly involved in the answering of questionnaires, time and distance was a limitation since it was difficult to know whether the questionnaire was understandable to both teachers and learners.
- The fact that a sample of 20 schools in the Mafikeng Area Project Office was investigated is a limitation as the findings cannot be generalized, but will give a deeper understanding of the concern schools.

5.6 RECOMMENDATIONS FOR FUTURE RESEARCH

Research on a larger scale is needed to see if the findings of the investigation can be generalized to all Senior Secondary Schools in Ngaka Modiri Molema District in the Northwest Province. The following should be focused:

- The relationship between the use of computers as tool and the National Curriculum Statement policy.
- Effective training strategies on how to use computer in the teaching and learning Mathematics and Mathematical Literacy.
- Are recommendations made in this chapter feasible to all the secondary schools in Mafikeng Area Project Office?

5.7 CONCLUSION

The research study has dealt with issues concerning the use of computers in the teaching and learning of Mathematics. In summary, the research has concluded that:

- Teachers and learners regard the computer as an effective tool in the teaching and learning process of Mathematics.
- The challenges in the use of computers can be identified as follows: lack of funds as most schools in MAPO are classified as no fee schools, lack of software and hardware, limited knowledge of computer skills of both teachers and learners; teachers are not trained or workshops to use computers in their Mathematics lessons. Learners don't have computers at home and those who have computers at school are not given the opportunity to use them.
- It is a fact that teachers are at the centre of curriculum change and they control the teaching and learning process. Therefore, they must be able to prepare young people for the knowledge society in which the competency to use computer technology to acquire and process information is very important (Afshari et al 2009:79).

Teacher training programmes play an important role in providing the necessary leadership in training pre-service and in-service teachers to deal with the current demands of society and the economy. They should model the new pedagogies and tools for learning with the aim of enhancing the teaching learning process. Moreover teacher education institutions and Teacher training programmes play an important role in providing the necessary leadership in training pre-service and in-service programmes. They should help teachers to understand how the new technologies can best be used in the context of the culture, needs and economic conditions of their country. Hence, building the capacity of teachers in the use of computer requires long-term continuous development of the leading trainers, sharing of knowledge among teachers' partnerships and collaboration among teachers and organizations, and support from principals and administrators.

These factors must be available in order to create changes in the classroom. Therefore both teachers and trainers require ongoing support and opportunities to experiment with new skills and strategies over time (Afshari et al; 2009:97).

REFERENCES

Adekomi,A.A.(2001).*Introduction of computer Education.* An unpublished MonographIFe Obafemi Awolowo University.

Afshari, M;A. Abu, B.Su,L.W.Abu,S.B. & Say,F.F.(2009).*Factors affecting teachers use of Information &Communication Technology.Malaysia,2(1).*

Alter, D. (1993).*Using Technology to assess learner learning.* Available online:http:www.technology.co.za.

Bada, T. Adwole, A. & Olalekan, O.*(2009). Uses of computer and its relevance to teaching and learning in Nigerian educational system. Obafemi Awolowo University, Ile – Ife. Available online:* http://www.academicjoutnals.org/ERR. 2009/09/22

Bednar, M.R. & Sweeder, J.J.(2005). Defining and applying idea technologies: *A systematic, conceptual framework for teachers. Computers in the schools.* 22(3):4.

Bruner,J.Available online:http://tip.psychology.org/bruner.htm/. 2010/02/19.

Chen, R. & Arvold, B. (2002). *Linking Teachers' Embedded Traditions to students' Images of Mathematics:* online: http://www.edu.uiuc.edu/meter/publications/documents/linking.pdf 2004 /12/11

Clements, D.H.*(2000).From exercises and tasks to problems and projects. Unique contributions of computers to innovate Mathematics education. The Journal of Mathematical Behavior.19(1).*

Cohen,L; Manion, L. & Morrison, K . *(2000).Research Methods in education (5th* ed).NewYork:RoutledgeFalmer-Taylor &Francis Group.

Comradie,C.F.& Serlin,R.C.(2006). *The SAGE handbook for Research in Education.* London: SAGE Publicastions Inc.

Cook,C;&Cambell,J.(2002). *What is Research design?* Available: htttp:www.und.nodak.edu/ instruct/wstevens/Proposals class/Huntpaper.htm.

De Vos,A.S,Strydom;Fouche,C.B.& Delport,C,S,L.(2002). *Research at grass roots.(2nd* ed). Pretoria:Van Schaik.

Department of Education. (DOE),(2003). *National Curriculum statement grade (10 - 12) general policy:* Maths Literacy Pretoria: Government Printer.

Drew, C.J. Hardman, M. L. & Hosp, J. L. (2008). *Designing and Conducting Research in Education.* London: SAGE Publications Inc.

Fajola, O.O. *(2001). Computerisation of Examination Results: A case for consideration in colleges of Education.* The Coll. Rev. 8: 151 - 158

Ferbar, L. & Trkman, P. (2003)*.Impact of Information Technology on Mathematics Education: A Slovenian Experience.*London: SAGE Publications.

Fraenkel,J.R.& Walien N.E.(2008). *How to design and evaluate research in education (7th* ed).NewYork:Mc Graw-Hill international edition.

Frith, V; Jafta.J. & Prince, R. *(2004).Evaluating the effectiveness of interactive computer tutorials for an undergraduate mathematical literacy course.. British Journal of Educational Technology*, 35(2):159-171.

Golafshani, N.*(2002).*Teachers' conceptions of Mathematics and their Instructional Practices.*Philosophy of Mathematics education journal*, 15.

Goodyear, P. & Retalis, S. (2010). Technology-Enhanced Learning. *Design Patterns and Pattern Languages.* Rotterdam: Sense Publishers.

Haddad W, D. & Draxler, *A. (*2002*)*.The dynamics of Technologies for education. In W. D.Haddad and Daxler.*(Eds).Technologies for education: Potentials, Parameters &Prospects.(2002)* Washington DC: Academy for Educational Development.

Hardman,J. (2005).*A exploratory case study of a computer use in a primary school mathematics classroom, New technology; new pedagogy?*Perspectives in Education 23 *(4).*

Herselman, M. E. *(2003).ICT in Rural Areas in South Africa: Various case studies. Informing Science in SITE- "Where parallels Intersects "* Pretoria: Tech

Ittigson, R, J & Zewe, J.G. *(2003).*Technology in the mathematics classroom. In Tomei L.A. (Ed). *Challenges of teaching with technology across the curriculum.* New York: Information Science.

Johnson,B. & Christensen,L. (2008). Educational *Research (*3rd ed). London: SAGE Publications.
Leacy S. (1995).Software Review; *Mathematics in school.*24 (2):47-48.

Leedy, P. D. & Ormrod, S. (2001). *Practical research, planning and design.* (5th ed). New York: Macmillian.

Lems, C. (1979). Educational Technology: *A glossary of Terms.* Washington: AECT Publishers.
Maree , K. (2010). *First steps in Research.* Pretoria: Van Schaik Publishers.

McGraw,H.(2004). *Educational Psychology,Annual Editions.* New York:McGraw Hill Companies.

Mertler, C. A. *(2009). Action research: Teachers as researchers in the classroom. (*2nd ed). London: SAGE Publication.

Mhakure, D.(2003). *Information Technology as an Instrumental tool in the teaching of Mathematics in secondary schools. Perceptions of educators and learners in the North West Province.*Thesis.North-west university.Unplublised.

Mistretta, R.M. *(2005). Integrating Technology into the Mathematics classroom. The role of the teachers' preparation program. The Mathematics Educator. 15 (1): 18 - 24.*

Moila, M.M. *(2006).The use of Educational* Technology *in Mathematics Teaching and Learning:* Mini-dissertation .University of Pretoria: Unpublished.

Morrison, G, R. & Lowther, D. L. *(2002).Integrating computer technology into the classroom* .New Jersey: Pearson Education Inc.

National Council of Teachers of Mathematics (NCTM). *(2003). The use of Technology in the Learning and Teaching of Mathematics.* Retrieved June 30 .

Newby, J.T,Stepich, A.D. Lehman, J.D.& Russell, J.D. (2006).*Instructional Technology for Teaching and Learning: Designing Instruction, Integration (3r^{d} Ed)* Upper Saddle River New Jersey: Pearson Education Inc.

Nicol, D. & Boyle, J. (2003). Peer instruction versus class-wide discussion in large classes: A comparison of two interaction methods in the wired classroom. *Studies in Higher Education.28. 4.*

Oldknow, A. & Taylor, R. *(2002).Teaching Mathematics with ICT.*London: Continum.
Opie, C. (2004). *Doing Educational Research.*London:SAGE Publications.

Pritchard, A. (2007). Effective teaching with Internet Technologies, Pedagogy and Practice. London: Paul Chapman Publishing.

Provenzo,E. F. Brett, A.& Mc Closkey, G. N(2005). *Computers, curriculum and cultural change: An Introduction for Teachers.* New Jersey: Lawrence Erlbaum Associates, Inc.

Pudi,T.(2007). *Understanding Technology Education from a South African Perspective.* Pretoria: Van Schaik Publishers.

Punch, K. *(2000). Developing Effective research proposals.* London :SAGE.

Punch,K.F.(2009). Introduction to research methods in education. London: SAGE Publicastions.

Ronis,D.L.(2008), *Problem-based learning for Mathematics and Science: Integrating inquiry and the Internet,* Califonia: Corwin Press.

Rose-Innes, L. *(2007). ICTs and Higher Education in Africa.* South Africa , www.cet.uct.ac.za. Centre of Educational Technology.

Ruthven, K. & Hennessey, S. (2002). A *practical model on the use of Computer-Based Tools and Resources to Support Mathematics teaching and learning. Educational studies in Mathematics* pg 47-88 .Califonia: Corwen Press.

Saunders, M. Lewis, P. & Thornhill, A. (2003). *Research Methods for Business students. (*3rd Ed). London: Prentice Hall.

Suter, W.N. (2006).*Introduction to Educational Research. A critical Thinking Approach.* London :SAGE Publication.

Shackleford.M.(2001). *Shack's Math's Problems.* [online]www.shakleford.co.za.]

Sticht, T.Available online:http://tip.psychology.org/sticht.html. 2010/02/19.

Taft, C.A. (2000). *Rational for* Integrating *technology into the classroom.* [Online]Available{http://middle.usm.kl2-kl2.wi.us/faculty/taft/technology/report.htm[2004, February.12].

Trochim,W.M. (2000). *Research methods Knowledge base.* Available: http:www.und.nodak.edu/instruct/wstevens/Proposal class/Huntpaper.htm.2007/09/01.

Vaidez, G.(2005).Critical issue on Technology *Catalyst for Teaching and Learning in the Classroom.*http://www.nrel.org/sdrs/areas/issues/methods/technlgy/te 600.htm.

Wilson, J. *(2000).Technologies in Secondary Schools.* [Online] http://j.wilson.coe.uga.edu/Timer/Timer.S.htm. (2004,November 11).

Wodi,S.W. (2009).The Concept of Educational Technology:*Problems and Prospects of Information and Communication Technology (ICT).*Nigeria:EuroJournals Publishing,Inc. [online] http://www.eurojournals.com/Africa.htm.

APPENDIX A

QUESTIONNAIRE FOR LEARNERS

TOPIC: USING COMPUTERS IN THE TEACHING AND LEARNING OF MATHEMATICS IN SENIOR SECONDARY SCHOOLS.

INSTRUCTION TO LEARNERS

Please complete Section A and Section B

SECTION A

You are kindly requested to complete this section of the questionnaire by ticking ($\surd$) in the appropriate box provided at the end of the statement.

1. Type of school

Middle	
High	
Secondary	

2. Gender

Male	
Female	

3. Age

Less than 15	
15 – 17	
17 +	

4. Do you have computer at home?

Yes	
No	

5. Do you have computers at school?

Yes	
No	

SECTION B

For each item, respond by ticking ($\surd$) in the relevant box. Boxes are under columns labelled Strongly Agree, Disagree, Neutral, Agree and Strongly Disagree.

STATEMENT	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Computers can be used to learn Mathematics?					
2. Mathematics can be understood much better when they are taught without aids.					
3. Using computers to sketch various graphs, to find mean, mode and median.					
4. Computer lessons help the learner to explain Mathematical concepts.					
5. A learner finds the computer difficult to use because she/he do have it at home and she/he is given opportunity to use computers at school.					
6. My school does have enough computers for learners to practise their Mathematical ideas and calculations on.					
7. My Mathematics teacher need to show me how to use the computer to carry out Mathematical calculations and graphs.					
8. Learner does use Mathematical programmes on the computer.					

APPENDIX B

QUESTIONNAIRE FOR TEACHERS

TOPIC: USING COMPUTERS IN THE TEACHING AND LEARNING OF MATHEMATICS IN SENIOR SECONDARY SCHOOLS.

INSTRUCTION TO TEACHERS

Please complete Section A, Section B and section C

SECTION A:

You are kindly requested to complete this section of the questionnaire by ticking ($\surd$) in the appropriate box provided at the end of the statement.

1. Type of school

Middle	
High	
Secondary	

2. School Enrollment

100 – 250	
250 – 350	
350 – 450	
450+	

3. Highest Qualification

Matric + ACE	
University Diploma in Education Prim/Sec	
Higher Education Diploma	
Degree in Education	
Honors Degree	
Master Degree	
PhD Degree	

4. Age

Between 20 - 29	
30 – 39	
40 – 49	
50 – 59	
60 +	

5. Current position at school

Teacher	
Head of Department	
Deputy Principal	
Principal	

6. Teachers Teaching Experience

0 – 5	Yrs	
6 – 10	Yrs	
11 – 15	Yrs	
16 – 20	Yrs	
21 +	Yrs	

7. Subject Taught

Mathematics	
Computer Science	

8. Number of computers in your school

0 – 5	
6 – 10	
11 – 15	
16 – 20	
21 +	

9. Teacher – Learner Ratio

20 – 30	
31 – 40	
41 – 50	
51 – 60	
61 +	

SECTION B

Respond to each statement by ticking ($\surd$) in the relevant box. Boxes are under columns labelled Strongly Agree, Disagree, Neutral, Agree and Strongly Disagree.

STATEMENT	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
11. A computer is an important tool for learning and teaching of Mathematics at secondary schools?					
12. The use of computers to teach Mathematics enhances learners' performance.					
13. Computers make learners perform Mathematics calculations and draw graphs.					
14. There is enough software which can be used to teach Mathematics.					
15. Teachers use computers in their lessons because their knowledge of computers is not limited.					
16. Teachers have been trained to use computers for teaching Mathematics.					
17.Lack of funds in schools impedes the use of computer					
18. There are technicians on site to maintain the computers.					
19. The School do have infrastructure to accommodate the computers.					
20. More workshops on how to use computers for teaching and learning Mathematics should be organized by the Education Department.					

SECTION C

This section is intended to find out challenges faced by teachers when using computers in the teaching of Mathematics.

21. It is necessary for each teacher who is teaching Mathematics to have computer skills. Motivate your answer:

_____
_____
_____
_____

22. What challenges are you facing when using computers in teaching Mathematics?

_____
_____
_____
_____

23. Using computers in the classroom makes my lesson simple. Elaborate

_____
_____
_____
_____

APPENDIX A 1

LEARNER`S RESPONSES

TOPIC: USING COMPUTERS IN THE TEACHING AND LEARNING OF MATHEMATICS IN SENIOR SECONDARY SCHOOLS.

INSTRUCTION TO LEARNERS

Please complete Section A and Section B

SECTION A

You are kindly requested to complete this section of the questionnaire by ticking (√) in the appropriate box provided at the end of the statement.

6. Type of school

Middle	
High	
Secondary	√

7. Gender

Male	
Female	√

8. Age

Less than 15	
15 – 17	
17 +	√

9. Do you have computer at home?

Yes	
No	√

10. Do you have computers at school?

Yes	√
No	

SECTION B

For each item, respond by ticking ($\sqrt{}$) in the relevant box. Boxes are under columns labelled Strongly Agree, Disagree, Neutral, Agree and Strongly Disagree.

STATEMENT	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Computers can be used to learn Mathematics?	√				
2. Mathematics can be understood much better when they are taught without aids.				√	
3. Using computers to sketch various graphs, to find mean, mode and median.		√			
4. Computer lessons help the learner to explain Mathematical concepts.		√			
5. A learner finds the computer difficult to use because she/he do have it at home and she/he is given opportunity to use computers at school.		√			
6. My school does have enough computers for learners to practise their Mathematical ideas and calculations on.		√			
7. My Mathematics teacher needs to show me how to use the computer to carry out Mathematical calculations and graphs.		√			
8. Learner does use Mathematical programmes on the computer.					√

APPENDIX B 1

TEACHER`S RESPONSES

TOPIC: USING COMPUTERS IN THE TEACHING AND LEARNING OF MATHEMATICS IN SENIOR SECONDARY SCHOOLS.

INSTRUCTION TO TEACHERS

Please complete Section A, Section B and section C

SECTION A:

You are kindly requested to complete this section of the questionnaire by ticking ($\surd$) in the appropriate box provided at the end of the statement.

3. Type of school

Middle	
High	
Secondary	$\surd$

4. School Enrollment

100 – 250	
250 – 350	
350 – 450	
450+	$\surd$

3. Highest Qualification

Matric + ACE	
University Diploma in Education Prim/Sec	
Higher Education Diploma	
Degree in Education	√
Honors Degree	
Master Degree	
PhD Degree	

4. Age

Between 20 - 29	
30 – 39	√
40 – 49	
50 – 59	
60 +	

5. Current position at school

Teacher	√
Head of Department	
Deputy Principal	
Principal	

6. Teachers Teaching Experience

0 – 5	Yrs	
6 – 10	Yrs	
11 – 15	Yrs	√
16 – 20	Yrs	
21 +	Yrs	

7. Subject Taught

Mathematics	√
Computer Science	

8. Number of computers in your school

0 – 5	
6 – 10	
11 – 15	
16 – 20	
21 +	√

9. Teacher – Learner Ratio

20 – 30	
31 – 40	√
41 – 50	
51 – 60	
61 +	

SECTION B

Respond to each statement by ticking (√) in the relevant box. Boxes are under columns labelled Strongly Agree, Disagree, Neutral, Agree and Strongly Disagree.

STATEMENT	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
11. A computer is an important tool for learning and teaching of Mathematics at secondary schools?	√				
12. The use of computers to teach Mathematics enhances learners' performance.	√				
13. Computers make learners perform Mathematics calculations and draw graphs.	√				
14. There is enough software which can be used to teach Mathematics.					√
15. Teachers use computers in their lessons because their knowledge of computers is not limited.					√
16. Teachers have been trained to use computers for teaching Mathematics.					√
17.Lack of funds in schools impedes the use of computer	√				
18. There are technicians on site to maintain the computers.					√
19. The School do have infrastructure to accommodate the computers.					√
20. More workshops on how to use computers for teaching and learning Mathematics should be organized by the Education Department.	√				

SECTION C

This section is intended to find out challenges faced by teachers when using computers in the teaching of Mathematics.

21. It is necessary for each teacher who is teaching Mathematics to have computer skills. Motivate your answer:

Computer skills are important for teachers to teach Mathematics because the outcomes need learners to collect data and analyze it.
Computer skills will enable teachers to go with times.
Mathematics teachers should have computer skills so that they should access information from internet.

22. What challenges are you facing when using computers in teaching Mathematics?

Lack of funds. Most schools are classified as no fee schools.
No computer laboratories to store computers.
No Mathematical software
Time allocations for Mathematics are four and half hours per week and the syllabus is long.
Teachers are computer literate.
Learners are also computer literate.

23. Using computers in the classroom makes my lesson simple. Elaborate

Teachers are not using computers.
Teachers never use computers in the classroom.
Not yet experienced that because we don't have computers in the school.

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

Faculty of Education

School of Postgraduate Studies

25 August 2010

TO WHOM IT MAY CONCERN

RE: PERMISSION TO CONDUCT RESEARCH IN YOUR SCHOOL.

I wish to confirm that **Ms Enihe, LM** Student No: **16074424** is currently registered for Masters (MEd) Educational Technology (North West University); Mafikeng Campus.

Ms Enihe needs to collect data for her research from various secondary school in the Mafikeng Area Project Office (APO) of the North West Province. I therefore request that she be given the necessary assistance in this regard.

Thank you in anticipation of your cooperation and assistance.

.....

Prof JR Debeila
Director: School of Postgraduate Studies

SCHOOL OF POSTGRADUATE STUDIES
2010 -08- 25
FACULTY OF EDUCATION
DIRECTOR'S OFFICE

DEPARTMENT OF EDUCATION
MAFIKENG A.P.O.
2010 -09- 29
Private Bag X2047
Mmabatho
2735

18 Boipelo Street
Unit 3
MMABATHO
2735

29 October 2010

CERTIFICATE OF LANGUAGE EDITING

TITLE OF DISSERTATION

Using computers in the teaching and learning of Mathematics
in senior secondary schools around Mafikeng Area Project Office.

SUBMITTED BY

Lillian Madikobe Enihe

FOR THE DEGREE OF

Master of Education
(Education Technology)

IN THE

School of Post-Graduate Studies
Faculty of Education
North-West University
Mafikeng Campus

Has been edited for language and other details by:

Prof. SA Awudetsey

Prof. SA Awudetsey
0722371390